INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION

1913

PROCEEDINGS OF THE

International Railway General Foremen's Association

HOTEL SHERMAN, CHICAGO, ILL.
JULY 15, 16, 17 AND 18, 1913

Compiled and Published by
WM. HALL
Winona, Minnesota

REPORT OF PROCEEDINGS

of the

NINTH ANNUAL CONVENTION

of the

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION

Held at

HOTEL SHERMAN, CHICAGO, ILLINOIS
JULY 15, 16, 17 AND 18
1913

Officers for 1913-1914

PRESIDENT
W. W. SCOTT, General Foreman, D. L. & W. Ry.
Buffalo, N. Y.

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Indianapolis, Ind.

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829 W. Broadway, Winona, Minn.

EXECUTIVE COMMITTEE.

*W. G. REYER, Gen. Foreman, N. C. & St. L. Ry.
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**GEO. H. LOGAN, Gen. Foreman, C. & N. W. Ry.
Missouri Valley, Iowa.

***C. M. NEWMAN, Gen. Foreman, A. C. L. Ry.
Rocky Mountain, N. C.

* Term expires 1914.
** Term expires 1915.
*** Term expires 1916.

Committees Selected for 1914 Convention

Subject No. 1.

Engine House Efficiency:
WALTER SMITH, Chairman.
C. & N. W. Ry.,
Chicago, Ill.

Subject No. 2.

Cylinders, Pistons, Cross-heads, Guides and Valves:
J. T. MULLIN, Chairman,
Gen. Foreman, L. E. & W. Ry.,
Lima, Ohio.

Subject No. 3.

The practice and methods of maintenance and repairs to the air brake and its appurtenances.
C. M. NEWMAN, Chairman,
Mach. Shop Foreman, A. C. L. Ry.
Rocky Mountain, N. C.

Subject No. 4.

Autogeneous Welding,
C. L. DICKERT, Chairman,
M. M. Cen. of Georgia Ry.,
Macon, Ga.

Subsidiary Paper No. 1.

The Taylor System, by
W. W. SCOTT,
Gen. Foreman, D. L. & W. Ry.,
Buffalo, N. Y.

Subsidiary Paper No. 2.

Railroading at a high altitude, by
J. W. SCOTT, Ass't Locomotive Supt.,
So. Railways of Peru. La Paz,
Bolivia.

ATTENTION!

When writing the Secretary-Treasurer upon any matter whatever and after waiting a reasonable length of time you do not receive an answer to your communication, make up your mind that something is wrong somewhere and write him again, remembering that Uncle Sam is not infallible, but of course your secretary is (not), and mail does go astray once in awhile.

Names and Addresses of Members

The Secretary requests all members to write him at least once every quarter and sign his name, P. O. address, railroad, and capacity.

ACTIVE MEMBERS.

Name.	Road.	Address.
Abington, W. T	Gen For, C R I & P	Trenton, Mo.
Airhart, N. S	C R I & P	
Armantage, J	Div For, A T & S F	Seligman, Ariz.
Ashmore, C. D	Gen For, C & N W	Clinton, Iowa.
A'Hearn, F. M	M. S. For, B & L E	Greenville, Pa.
Anderson, J. W	M M, C & N W	Boone, Iowa.
Barnes, Chas. A	Gen For. C & W I & B	Chicago, Ill.
Barrett, A. D	R H F, Big Four	Mattoon, Ill.
Bass, J. F	Gen For, Tex Cen	Walnut Springs, Tex.
Baumgardner, F. M	M M, I C Ry	Clinton, Ill.
Bauer, John H	N & W Ry	Williamson, W. Va.
Bauer, Ferdinand	G F, Big Four	Urbana, Ill.
Beland, Ben	M M, S T L & S F	Birmingham, Ala.
Bingham, G. C	Gen For, C & N W	Winona, Minn.
Bloom, E. B	M F, C & N W	Chicago, Ill.
Black, R. L	R H F, N & W	Ceredo, W. Va.
Bowersox, C	Gen For, T & O C Ry	Bucyrus, O.
Boyden, J. A	M M, Erie	Cleveland, O.
Brinker, W. R	Gen For, C R I & P	Goodland, Kan.
Breisch, O. C	Gen For, C R I & P	Ardale, Kan.
Bradford, A. F	Big Four	Urbana, Ill.
Bronson, G. E	For, C R I & P	Philipsburgh, Kan.
Burton, L. J	R H For, M & St L	Des Moines, Iowa.
Bunker, W. D	M M, Col & Wyo	Pueblo, Colo.
Burke, T	For, I C Ry	Clinton, Ill.
Burdge, C. A	R H For, B & O	Chicago Junction, O.
Butler, J	Gen For, Big Four	Beech Grove, Ind.
Burleigh, W. H	Gen For, C R I & P	Eldon, Mo.
Carley, W. F		Galeton, Pa.
Case, A. B	Gen For, St L & S F & T	Sherman, Tex.
Callahan, J. M		Selma, Ala.
Cather, H. K	Gen For, M K & T	Smithville Tex.
Casey, J. J	Gen For, I C	Chicago, Ill.
Christy G. C	Ass't M M, I C	Water Valley, Miss.
Chapman, L	Gen For, C & N W	Norfolk, Neb.
Clough, W. H	Gen For, Erie	Hammond Ind.
Cook, G. W	M S For, P M Ry	St. Thomas, Ont., Can.
Conrad, S. A	Gen For, L H & St L	Cloverport, Ky.
Corbett, A. B	R H For, M K & T	Dennison, Tex.
Crone, A. R	R H For, C & O	Thurmond W. Va.
Cuyler, G. W	Gen For, M & St L	Marshalltown, Ia.
Dickert, C. L	M M, C of Ga	Macon, Ga.
Dimmitt, H. G	Gen For, C M & St P	Minneapolis, Minn.
Downes, C. W	Gen For, C T H & So E	Bedford, Ind.
Doerr, C. H	Gen For, U. P Ry	Omaha, Neb.
Donnelly, J. J	Gen For, M O & G	Muskogee, Okla.
Duckett, Geo	Dist For, I C	Louisville, Ky
Dunn, H. F	For Medina Irr'n Co	Mico, Tex.
Eisele, H	Gen For, Wabash	Fort Wayne, Ind.
Ensign, H. W	R H For, C G W	Chicago, Ill.
Fay, E. F	Ass't M M, I C	Waterloo, Ia.
Farrell, W. E	Gen For, Big Four	Bellefontaine, O.
Finch, J. W	Gen For, C R I & P	Chickasha, Okla.
Finical, J. A	Gen For, Erie	Gallion, O.

Name.	Road.	Address.
Fowler, W. F	R H For, N P Ry	Billings, Mont.
Fromm, C. W	M S For, C I & S	Kankakee, Ill.
Fromm, A. B	Gen For, C I & S	Hammond, Ind.
Franklin, A. T	Gen For, I. C. Ry	Jackson, Tenn.
Freeman, T. E	Gen For, D & I R	Two Harbors, Minn.
Gale, W T	M S For, C & N W	Chicago, Ill.
Gallie, R	Erect For, Iron Mt	Little Rock, Ark.
Gibson, M. O	R H For, D & H	Albany, N. Y.
Gillespie, H. C	Gen For, C & O	Russell, Ky.
Groening, W. C	Supt Shops, P M	Grand Rapids, Mich.
Granger, L. M	Ass't Gen For, Erie	Galion, O.
Grosh, G. P	For, Wabash	Fort Wayne, Ind.
Griffin, T. F	Gen For, Big Four	Indianapolis, Ind.
Griffith, Wm	For, P M	St. Thomas, Ont., Can.
Hall, Wm	C & N W Ry	Winona, Minn.
Hayes, M. J	Gen For, T H & B	Hamilton, Ont., Can.
Hardin, L. A	Gen For, C & N W	Boone, Ia.
Harvey, E. W	Western Motor Co	Sedalia, Mo.
Hinnerman, W G	R H For, C & O	Thurmond, W. Va.
Hickey, F. E	Dist For, S. P. Ry	Imlay, Nev.
Hitch, C. B	Gen For, C. & O	Covington, Ky.
Hoffman, W. W	Gen For, C. & N W	Milwaukee, Wis.
Holden, G. A	Gen For, M C Ry	Grayling, Mich.
Hobbs, C	Gen For, A A Ry	Owosso, Mich.
Hott, J. H	Gen For, A T & S F	Wichita, Kan.
Ingrund, Geo. W	Gen For, C P & St L	Jacksonville, Ill.
Ingram, H	Loco For, C P Ry	Roseberry, Can.
Johnson, J. S	R H For, D & I R	Two Harbors, Minn.
Junker, A. A	R H For, P M	Plymouth, Mich.
Keller, G. W	Gen For, N & W Ry	Portsmouth, O.
Keller, R. W	Gen For, W. M. Ry	Hagerstown, Md.
Keiffer, H. W	Div For, H & T C	Dennison, Tex.
Kerwin, J. M	R H For, C R I & P	Silvis, Ill.
Kathe, C. A	Gen For, Erie	Jersey City, N. J.
Lawther, R. M	R H For, N P Ry	Minneapolis, Minn.
Lawer, W. F	Gen For, Erie	Huntington, Ind.
Lemon, J	Gen For, Mo Pac	Hoisington, Kan.
LeMieux, J	C C & L	Indianapolis, Ind.
Lickey, T. G	M S For, L S & M S	Chicago, Ill.
Linthicum, P	Ass't Shop Supt, CRI&P	Silvis, Ill.
Linck, P. C	Gen For, C & E I	Danville, Ill.
Little, S. B	Gen For, Mo. Pac	Nevada, Mo.
Logan, G. H	Gen For, C & N W	Missouri Valley, Ia.
Lucas, H	Loco For, A C & H B	Michipicoten, Ont., Can.
Marsh, E. C	R H For, N & W	Portsmouth, O.
Masters, A. A	Gen For, D & H Ry	Watervliet, N. Y.
Marshall, J	R H For, N P	Forsyth, Mont.
Martyr, H. F	Gen For, C R I & P	Eldorado, Ark.
MacConnell, W. R	R H For, G H & S A	San Antoine, Tex.
McMahn, E. J	Gen For, A T & S F	La Junta, Col.
McQuade, G N	Gen For, C R I & P	Eldon, Ia.
McGuirk, W. J	R H For, I C	Louisville, Ky.
McQuade, P. J	Gen For, C R I & P	Rock Island, Ill.
McCoy, S. E	Div For, Frisco	Cherokee, Kan.
McQuade, T. E	R H For, C R I & P	Oak Park, Ill.
Meeder, W. R	Gen For. C & E I	Dolton Junction, Ill.
Mills, Wm	R H For, M O M & C Ry	Mobile, Ala.
Mills, A. B	M S For, C H & D	Indianapolis, Ind.
Miller, F. O	Gen For, C M & St P	Dubuque, Ia.
Miller, J	Gen For, I C	Burnside, Ill.
Moist, H. I	Gen For, R F & P Ry	Richmond, Va.
Moore J. B	M M, C & N W	Eagle Grove, Ia.

Name.	Road.	Address.
Moats, C. W.	R H For, P & L E.	Beaver Falls, Pa.
Morey, E. H.	Dem, C & N W.	Chicago, Ill.
Morgan, J. K.	Gen For, C R I & P.	Little Rock, Ark.
Murray, E. A.	M M, C & O Ry.	Lexington, Ky.
Mueller, F. E.	Gen For, C R I & P.	Fairbury, Neb.
Murray, W.	Mach For, I C.	Burnside, Ill.
Mullin, T. J.	Gen For, L E & W.	Lima, O.
Nanney, T. H.	Gen For, B & S Ry.	Galeton, Pa.
Newman, C. M.	M S For, A C L.	Rocky Mt., N. C.
Nelson, A. W.	Div For, Frisco.	Neodesha, Kan.
North, L. A.	Shop Supt, I C.	Burnside, Ill.
O'Brien, Wm.	Gen For, I C Ry.	Macomb, Miss.
O'Connor, E. F.	Gen For, U P Ry.	Ellis, Kan.
Ogden, T. H.	M M, Crystal Ice Co.	Las Vegas, N. M.
Ormsby, W.	Erect For, I C Ry.	Burnside, Ill.
O'Neil, W. V.	M M, C C & U Ry.	Crystal City, Tex.
Olson, H O.	M S For, D & I R.	Two Harbors, Minn.
Paskersen, C.	Gen For, E P & F W.	Duran, N. M.
Pickard, F. C.	M M, D L & W.	Buffalo, N. Y.
Plothow, H. F.	Gen For, C & A Ry.	Chicago, Ill.
Plummer, V. L.	Gen For, OWR&N&OSL.	Huntington, Ore.
Powell, F. J.	M K & T Ry.	Denison, Tex.
Pohlman, W.	F M S, N Y O & W.	Middletown, N. Y.
Pye, J. P.	Gen For, C & O Ry.	Covington, Ky.
Quandt, Wm. H.	Gen For, C C C & St L.	Wabash, Ind.
Rafferty, C. D.	Gen For, K & M.	Middleport, O.
Ran, F J.	Gen For, G R & I.	Cadillac, Mich.
Reyer W. G.	Gen For, N C & St L.	Nashville, Tenn.
Reams, J W.	Gen For, A C L.	Florence, S. C.
Rhoades, H.	Gen For, Ia Cen.	Oskaloosa, Ia.
Riley J. L.	Gen For, C St P M & O.	Sioux City, Ia.
Rischman, L. P.	Gen For, P M.	Bay City, Mich.
Ronaldson, F.	Gen For, C R.	Toronto, Can.
Roth, H. L.	Gen For, C M O & T P.	Ludlow, Ky.
Scudder, C. J.	Shop Supt, P M.	Saginaw Mich.
Schultz, E.	M M, C & N W.	Green Bay, Wis.
Schlageter, J.	Gen For, Toledo Ter.	Toledo, O.
Schumacher, J.	Gen For, N Y C & St L.	Chicago, Ill.
Scott, W. W.	Gen For, D L & W.	Buffalo, N. Y.
Scotty, J .H.	A Loco Supt, S Ry of Peru.	La Paz, Bolivia.
Sentman, H J.	R H For, P C C & St L.	Bradford, O.
Shivers, G C.	M S For, C of G.	Savannah, Ga.
Showell, L.	R H For, A T & S F.	Dodge City, Kan.
Sheppard, J. T.	R H For, Soo Line.	Weyerhauser, Wis.
Sheafe, J. S.	Eng'r of Tests, I C.	Chicago, Ill.
Smith, Walter.	C & N W.	Chicago, Ill.
Smith, J. L. Jr.	G R H For, D L & W.	Buffalo, N. Y.
Smith, Wm.	Gen For, P & L E.	Carnegie, Pa.
Snyder, C.	R H For, A T & S F.	Chicago, Ill.
Stears, W. C.	M M, C H & D.	Lima, O.
Summers, J.	Gen For, Cent New Eng.	Maybrook, N. Y.
Sykes, A. R.	Gen For, I C.	Jackson, Tenn.
Syfan, H. P.	Div For, I C.	Carbondale, Ill.
Teasdale, G W.	M M, Tenn Copper Co.	Copper Hill, Tenn.
Therrien, D.	R H For, D & I R.	Two Harbors, Minn.
Thornberry, W. M.	Gen For, I C.	Clinton, Ill.
Toole, J. O.	Erect For, P M.	St. Thomas, Ont.
Toole, J O.	Erect For, P M.	Pere Marquette, Mich.
Turney, R. W.	Gen For, C & O.	Huntington, W. Va.
Vasseur, W. F.	Gen For, C & O.	Clifton Forge, Va.
Voges, C. H.	Big Four.	Bellefontaine, O.
Van Wormer, R. B.	Gen For, A C L.	Waycross, Ga.

Name.	Road.	Address.
Warner, H. E.	Gen For, L S & M S	Elkhart, Ind.
Wilson, R.	Gen For, C G W	Oelwein, Ia.
Wafer, Wm.	For, C & N W	Chicago, Ill.
Warcup, C. W.	Gen For, C R I & P	Silvis, Ill.
Walters, C. T.	Gen For, G N Ry	St. Paul, Minn.
Westbrook, M. H.	Mach For, G T Ry	Battle Creek, Mich.
Vehrle, F. W.	Gen For, D & N M	Knife River, Minn.
Whitford, W. A.	Div For, C & N W	Fond du Lac, Wis.
Whitaker, F. A.	R H For, Seaboard Air Line	Raleigh, N. C.
Wills, John H.	Gen For, C R I & P	Valley Junc., Ia.
Wilcox, M. S.	M. S. For, K & M	Middleport, O.
Windle, T.	Ass't M M, Ia Cent	Marshalltown, Ia.
Woodworth, C. B.	R H For, B & O	Chicago Junction, O.
Woelker, S. F.	R H For, St L S W	Illmo, Mo.
Wright, J. B.	Gen For, H V Ry	Columbus, O.
Young, E. J.	Gen For, Mo Pac	Fort Scott, Kan.
Zerbee, R. A.	M S For, C C C & St L	Bellefontaine, O.
Zinkan, Thos.	Gen For, Big Four	Indianapolis, Ind.

ASSOCIATE MEMBERS

Averill, E. A.	American Eng'r	New York, N. Y.
Bayley, H. P.	Pyle-Nat El Hd Lt Co	Chicago, Ill.
Bakersfield, Frank	Crucible Steel Co	Chicago, Ill.
Buckingham, J. E.	Standard Steel Works	Chicago, Ill.
Cleary, J. W.	Pyle-Nat El Hd Lt Co	Chicago, Ill.
Cizek, J. J.	The Leslie Co	Chicago, Ill.
Clark, D. G.	Firth-Sterling Steel Co	Chicago, Ill.
Colon, E. D.	C C to M M	Saginaw, Mich.
Cook, E. S.	Railway Journal	Chicago, Ill.
Cope, Jacob E.	Clarence Brooks & Co	Newark, N. J.
Ellet, Victor W.	Hunt-Spiller Corp	Chicago, Ill.
Edwards, F. W.	Ohio Injector Co	Chicago, Ill.
Flavin, P. E.	Standard Ry Eq Co	Chicago, Ill.
Furray, Frank W.	Ohio Injector Co	Chicago, Ill.
Homard, A. D.	Detroit Lubricator Co	Detroit, Mich.
Harris, D. T.	Am. Steel Foundries	St. Louis, Mo.
Johnson, J. Will.	Pyle-Nat El Hd Lt Co	Chicago, Ill.
Kilker, John E.	Pyle-Nat El Hd Lt Co	Chicago, Ill.
Kelley, H. D.	Goldschmidt Thermit Co	Chicago, Ill.
Leeds, Edw.	Niles-Bement-Pond Co	New York, N. Y.
Motherwell, J. W.	Ashton Valve Co	Chicago, Ill.
Nathan, C. A.	Nathan Mfg. Co	Chicago, Ill.
Neeley, B. J.	Jenkins Bros.	Chicago, Ill.
O'Malley, Edward	O'Malley-Beare Valve Co	Chicago, Ill.
Ransley, F. E.	Green, Tweed & Co	Chicago, Ill.
Rickselker, A. C.	Ajax Valve Co	Chicago, Ill.
Ross, Mark A.	Pyle-Nat El Hd Lt Co	Chicago, Ill.
Stocks, W. H.	Gold Car Heating Co	Chicago, Ill.
Stayman, J. M.	Gold Car Heating Co	Richmond, Va.
Thomas, A. R.	The Thomas Co	St. Louis, Mo.
Todd, John N.	Garlock Packing Co	Palmyra, N. Y.
Vissering, Harry	Harry Vissering & Co	Chicago, Ill.
Wallace, W. G.	Am. Steel Foundries	Chicago, Ill.
Wright, R. V.	Railway Age Gazette	New York, N. Y.
Walsh, F. J.	Chi. Pneu Toole Co	Richmond, Va.
Youngton, J. C.	H. W. Johns-Manville Co	Chicago, Ill.

HONORARY MEMBERS.

Dr. Angus Sinclair	J. F. DeVoy	Robert Quayle
I. L. Howland	Wm. S. Cozard	Joe Clough
J. W. Motherwell	C. H. Voges	

LIST OF MEMBERS IN ATTENDANCE, AND THEIR GUESTS.

NAME	POSITION	ROAD	LOCATION
Abbington, W. F.	G. F.	C R I & P Ry.	Trenton, Mo.
Ashmore, C. D.	G. F.	C & N W Ry.	Clinton, Ia.
Bauer, F.	G. F.	Big Four.	Urbana, Ill.
Barnes, C. A.	G. F.	Belt Ry.	Chicago, Ill.
Burleigh, W.	G. F.	C R I & P Ry.	Elden, Mo.
Burke, Thos.	G. F.	I C Ry.	Clinton, Ia.
Brewster, E. J.	G. F.	C & N W Ry.	Chicago, Ill.
Butler, J.	G. F.	Big Four.	Beech Grove, Ind.
Corbett, A. B.	R. H. F.	M K T Ry.	Dennison, Tex.
Conrad, S. V.	G. F. G. F.	L H & St L Ry.	Cloverport, Ky.
Christy, Geo. C.	G.F.A.M.M.	I C Ry.	Water Valley, Miss.
Clough, W. H.	G. F.	Erie Ry.	Hammond, Ind.
Chapman, L.	G. F.	C & N W Ry.	Norfolk, Neb.
Cook, G. W.	F. M. S.	P M Ry.	St. Thomas, Ont.
Cuyler, G. W.	G. F.	M & St L Ry.	Marshalltown, Ia.
Dickert, C. L.	A. M. M.	C of G Ry.	Macon, Ga.
Dailey, F. J.	Inst. App.	Erie Ry.	Susquehanna, Pa.
Engholdt, S. M.	S. F.	C & N W Ry.	Kaukauna, Wis.
Eisle, H.	G. F.	Wabash Ry.	Ft. Wayne, Ind.
Ensign, H. W.	R. H. F.	C G W Ry.	Chicago, Ill.
Foster, J. B.	G. F.	C & N W Ry.	Kaukauna, Wis.
Freeman, T. E.	G. F.	D & I Ry.	Two Harbors, Minn.
Fromme, A. B.	G. F.	C I & S Ry.	Hammond, Ind.
Griffiin, T. F.	G. F.	C C C & St L Ry.	Indianapolis, Ind.
Gale, W. T.	M. S. F.	C & N W Ry.	Chicago, Ill.
Gibson, M. O.	G. F.	D & H Ry.	Albany, N. Y.
Gardner, H.	Sup'r App.	N Y C & H Ry.	New York, N. Y.
Hall, Wm.	Sec'y.	C & N W Ry.	Winona, Minn.
Hoffman, W. W.	G. F.	C & N W Ry.	Milwaukee, Wis.
Hyde, Robt.	M. M.	C R I & P Ry.	Little Rock, Ark.
Hayes, M. J.	G. F.	T H & B Ry.	Hamilton, Ont.
Hobbs, C.	G. F.	Ann Harbor Ry.	Owosso, Mich.
Hendricksen, B.	T. R. F.	C & N W Ry.	Chicago, Ill.
Harden, L. A.	G. F.	C & N W Ry.	Boone, Ia.
Imgrund, G. W.	G. F.	C P & St L Ry.	Jacksonville, Ill.
Jones, W. E.	F.	C & N W Ry.	Chicago, Ill.
Logan, G. H.	G. F.	C & N W Ry.	Missouri Valley, Ia.
Lickey, C. G.	M. S. F.	L S & M S.	Chicago, Ill.
McQuade, R. J.	G. F.	C R I & P Ry.	Rock Island, Ill.
Murray, W.	M. S. F.	I C Ry.	Chicago, Ill.
Masters, A. A.	G. F.	D & H Ry.	Albany, N. Y.
Miller, J.	G. F.	I C Ry.	Chicago, Ill.
Mullin, T. F.	G. F.	L E & W Ry.	Lima, O.
Miller, F. B.	G. F.	C M & St P Ry.	Dubuque, Ia.
Mills, Wm.	R. H. F.	M O M & C Ry.	Mobile, Ala.
Mills, A. B.	M. S. F.	C H & D Ry.	Indianapolis, Ind.
McEldowney, W. E.	G. F.	D C Tram.	Denver, Colo.
North, L. A.	S. S.	I C Ry.	Chicago, Ill.
Nanny, T. H.	G. F.	B & F Ry.	Galeton, Pa.
Newman, C. M.	G. F.	A C L Ry.	Rocky Mt., N. C.
O'Toole, J. T.	G. F.	P M Ry.	St. Thomas, Ont.
Ormsby, Wm.	R. H. F.	I C Ry.	Chicago, Ill.
Pickard, F. C.	M. M.	D L & W Ry.	Buffalo, N. Y.
Pye, J. P.	G. F.	C & O Ry.	Covington, Ky.
Quandt, W. H.	G. F.	Big Four.	Wabash, Ind.
Reyer, W. G.	G. F.	N C & St L Ry.	Nashville, Tenn.
Rafferty, C. D.	G. F.	K & M Ry.	Middleport, O.
Riley, J. L.	G. F.	C St P M & O Ry	Sioux City, Ia.
Ravlin, F. J.	R. Eng.	C & N W Ry.	Chicago, Ill.

Name	Position	Road	Location
Scott, W. W.	G. F.	D L & W Ry.	Buffalo, N. Y.
Smith, W.		N Y C Ry.	New York, N. Y.
Smith, Mr.	S. F.	P & L Ry.	Pittsburgh, Pa.
Smith, W. R.	M. M.	C & N W Ry.	Chicago, Ill.
Sheafe, J. F.	Eng'r Tests.	I C Ry.	Chicago, Ill.
Sykes, A. R.	G. F.	I C Ry.	Jackson, Tenn.
Sheppard, J. T.	G. F.	Soo Line.	Weyerhaueser, Wis.
Sentman, H. F.	R. H. F.	P H Ry.	Bradford, O.
Sasser, H. W.	G. F.	Erie Ry.	Huntington, Ind.
Shreeve, J. C.	M. M.	E J & E Ry.	Joliet, Ill.
Turney, R. W.	G. F.	C & O Ry.	Huntington, Va.
Tinker, T. H.	S. M. P.	C & E I Ry.	Danville, Ill.
Thomas, F. W.	Sup'r App.	A T & S F Ry.	Topeka, Kan.
Vassuer, W. F.	G. F.	C & O Ry.	Clifton Forge, Va.
Whitford, W. F.	G. F.	C & N W Ry.	FonduLac, Wis.
Wright, B.	G. F.	H V Ry.	Columbus, O.
Williams, T. E.	B. F.	C & N W Ry.	Chicago, Ill.
Woods, H. G.	G. F.	C & O Ry.	Clifton Forge, Va.

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American Balance Valve Co.
American Arch Co.
American Steel Foundries.
Angus Sinclair Co.
Anchor Packing Co.
Barco Brass & Joint Co.
Bettendorf Co.
Buda Company
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Cleveland Twist Drill Co.
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Equipment Improvement Co.
Edna Brass Co.
Firth-Sterling Steel Co.
Franklin Railway Supply Co.
Flannery Bolt Co.
Goldschmidt Thermit Co.
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Railway List.
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Jos. T. Ryerson & Son.
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Railway Age Gazette.
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Griffin Wheel Co.
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PROCEEDINGS

—— of ——

The Ninth Annual Convention of the International Railway General Foremen's Association.

President F. C. Pickard called the meeting to order at 10:30 o'clock and introduced the Rev. Samuel Fallows, Presiding Bishop of the Reformed Episcopal Church, who invoked Divine blessing.

PRAYER.

Oh, God, Thou art our Father. We are made in Thine image. We are endowed with powers like the Divine. We are here in this world to think Thy thoughts and to manifest Thee. We thank Thee for this marvelous exhibition of the powers with which we have been gifted. May we ever reflect our Divine lineage, and in doing these things may we ever remember that we are but reflecting Thee.

We pray that Thy divine blessing may rest upon these Thy servants as they shall meet in this convention. Continue to give them the spirit of sympathy and charity; so may we think the things by Thy divine inspiration, which are right, and by Thy merciful guidance perform the same, and the glory shall be Thine, world without end, Amen.

PRESIDENT PICKARD: Reverend Fallows, we thank you. We have with us this morning as a representative of the City of Chicago and Mayor Harrison, Mr. Leon Hornstein, who will now address you.

ADDRESS OF MR. LEON HORNSTEIN

Mr. President, Ladies and Gentlemen:

On behalf of the City, I bid you welcome. I come to extend the glad hand of fellowship and to tender to you the freedom of the City while you are here attending this convention. I feel myself doubly honored in being permitted to address you on this auspicious occasion. I feel honored because the gentleman who is at the head of civic affairs in this great metropolis has seen fit to delegate me to represent him and to address you in his behalf, he being unable to lend his distinguished presence to your gathering this morning. And I feel honored also because I have the opportunity of meeting and speaking to a body of men who are so thoroughly representative of the progressive era in which we live. It can be said of gentlemen of your profession that you are among those who are the leaders in the great work that is going on about us, tending towards better conditions and a higher civilization. For it must be admitted by all who have given the subject any consideration at all that in the fore front of all these inventions that have made for a higher civilization,—those that have annihilated time and distance are in the lead, and a convention of railway men—the practical men who actually do things and run things and handle things about a railroad, represent the type of men who are ever at work, striving for the betterment of humanity. And, therefore, I say I feel highly honored to be able to say a few words to you at the opening of your convention.

I speak of it as an auspicious occasion. I used the word advisedly, because it seems to me that this convention bids fair to mark an era in the history of railroading. In the first place, you meet this morning under conditions that must be highly satisfactory to you as they are most gratifying to all who are not engaged in the actual business of railroading. We see by this morning's paper that the clouds that have been hovering dark and threatening for some time past are about to be dispelled. The atmosphere is clearing; peace looms up on the horizon instead of war. That must be a subject of congratulation to you, and I will say on behalf of the City of Chicago, that we join you most heartily in your felicitations.

Again, you are gathering for this convention in a City which above all others is the most appropriate for a gathering of railroad men. I take it that there is hardly a man among you, although you have come from all parts of the United States and I understand to some extent from Canada—I take it

that there is hardly a man among you who has not been to Chicago before. Railroad men are men of affairs who travel about and see things and learn by experience in these days when it has become unfashionable to accept railroad passes it is probable that before long the railroad men themselves will be the only ones who will be in a position to say that they have traveled about a good deal. So I assume that you are not strangers to Chicago, and I presume also that you know that this is a great railroad center of the world. Here in Chicago have been solved the greatest problems of railroad engineering that have arisen to plague the men in your business. Here in Chicago in all probability the future development of the railway business will be greatest, and that there is progress and rapid progress we can see by looking about us.

I have a very distinct recollection of listening to a railroad official something like 23 years ago at a gathering of notable men in this City. I do not like to admit in the presence of the ladies that I remember these things 23 or 24 years ago as well as I do, and it would probably be better to say some years ago, but on this occasion I have reason for specifying the number of years, and therefore, I must admit that at that time I was able to set up and take notice. I remember at that time of a very high railroad official speaking to a gathering of leading men of the City stating to them that such a thing as the elevation of railroad tracks in the City of Chicago was a thing utterly unthinkable. He said it would bankrupt every road entering the City. And here today if you will take the trouble to look around, you will find that practically all grade crossings in the City of Chicago have been abolished. It is true you will find them in the outskirts of the City more or less, but they are going out so rapidly that in the course of from three to five years more there will be no grade crossings in this City. There is progress such as was not dreamed of twenty-five years ago.

I believe that there are great problems confronting you today,—the problem of terminal electrification and other matters of that kind, are on the verge of solution. I cannot believe that men who are always looking for improvement, who are always on the alert for a road's improvement, can fail to adopt some progressive idea—can longer be staggered or hindered by any problem of the kind that now confronts you. It is true other problems will arise, but as they come up the men who are railroading, who are engaged in the active work, who are real railroad men, will always be able to meet them.

I am afraid I am talking rather too long, and to recur to the subject of my mission, I wish to say to all of you that the City of Chicago is glad, and the administration at the head of the affairs of this City is glad to have you hold your convention at this place. Those of you who have come from afar, we hope you will be able to take time enough from your deliberations to look about you and see what there is in this magnificent City. I hope you will not be content with remaining down town and craning your necks looking up at the tall buildings and taking the ladies down street to show them the great shops, but I hope you will go to the different parks of the City. Take the ladies over our magnificent boulevards, and notice what we have in our grand parks. There is a conservatory in the one to the East that is regarded as the finest in the country. There is a museum in the one to the South that is well worthy of the time of any man, no matter how busy he is. I am satisfied he will feel himself amply repaid for paying a visit to it. In our park to the North you will find a splendid zoo that will afford delight and amusement to any children you have with you and will interest and instruct you. There are other things that will no doubt interest you in this City. The stockyards always furnish a certain amount of entertainment and instruction to those who visit them. I am a great believer in the stockyards. I think it is the highest form of art that we have in this City. Those of you who are of the other school of art may visit the art gallery on the Lake front, but if you want real art, go out and see some pigs killed. It will be entertaining and instructive.

I might go on and tell you of different things we have here, but I know you will have plenty of people who will advise you and guide you and entertain you while you are here. All that I urge upon you is that you should not be in too great a hurry to get away; that you should not stick too close to the matters that you have under consideration here. Take time, go about


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Hotel Sherman July 13 1903.
Chicago.
Kaufmann Fabry Co.
Chicago

the City and see what we have, and if there is anything that you see that you want, come over to the City hall and we will give it to you. (Applause).

RESPONSE BY MR. W. T. GALE.

Mr. President, Ladies and Gentlemen, and the Honorable representative of Chicago:

It is with a feeling of hesitation—I might say almost fear—that I accept the kind invitation of the President in behalf of the International Railway General Foremen's Association, to respond to the most cordial and glad welcome of Mr. Hornstein. I presume I need not make any apologies for the fact that I am not an orator, because you will know that being an active member of this organization it is to be expected that every representative, no matter what part of the world the man comes from, can represent himself in his official capacity. We take it for granted that every member of this Association and Supply Men's Association is a man of talent and ability and necessarily of intelligence, so that there should be no fear on my part to address such a meeting on so auspicious an occasion.

The representative of the Mayor of Chicago has stated that as he understands it,—and I can assure him on behalf of this Association that it is true—that this is a progressive organization, fostered and built up by progressive men.

Mr. Hornstein has touched upon a point that has been fixed in my mind in connection with this organization, and one of deep interest to us as citizens of Chicago, is transportation. The City of Chicago, the second largest City of the United States and I dare say in the near future the first, has great possibilities in the matter of transportation of its citizens and its visitors, and I dare predict, as we have predicted on previous occasions, looking into the future as intelligent men should, that if ever a solution to the question of ideal transportation is found, it will be by some railroad man; possibly a member of our own organization will provide the solution.

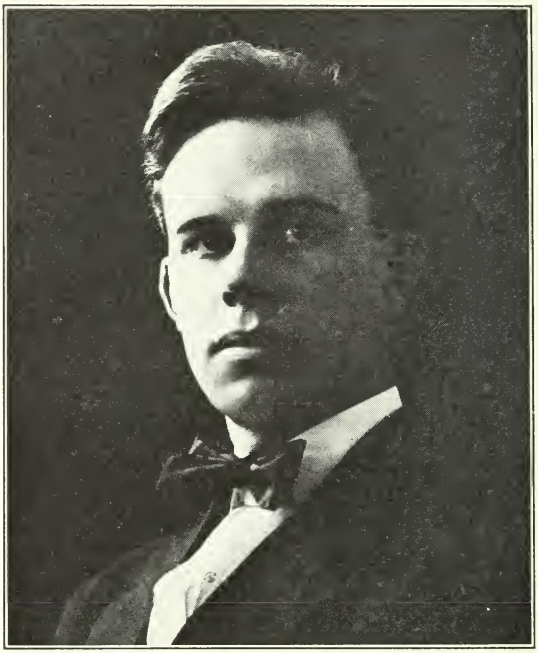
The Mayor's representative has called the attention of our members to the many attractive features in Chicago; those of us who are residents are familiar with them and we appreciate them. We enjoy them and take advantage of them, and it is up to the gentlemen and their ladies who are with us this week to participate with and enjoy the features that this great and wonderful City has invited us to enjoy

The representative of this local government is closely allied with the representative of the State of Illinois, which you all know is the greatest State in the union. I would not mention it were it not for the fact that there are ladies present, and the Governor of Illinois only recently had the great honor to attach his signature to a bill that is going to give the ladies the advantage over us men. The woman's suffrage bill has been passed in Illinois, and it behooves the male residents to be prepared for the battle that the ladies are going to give us on all public questions. And I want to say at this moment, if you will pardon me, that I believe it is going to be a great feature in the progressive spirit of the City of Chicago. I do not believe that there is going to be any one feature that will tend to purify and uplift the ideals of a great big City like Chicago more than the women. It is going to be brought about and the issue is going to be forced upon our women. And all I can say in conclusion is: "May God bless them and may they fight hard and well."

In behalf of the International Railway General Foremen's Association, and I take in the Supply Men's association, Mr. Hornstein, it is with a feeling of great pleasure and gratification that we accept your kind invitation to the freedom of Chicago and all it contains. (Applause).

ADDRESS OF PRESIDENT F. C. PICKARD.

It is with a deep personal appreciation of the privilege and with sincere pleasure that I welcome you to the ninth annual convention of the International Railway General Foremen's Association; the third consecutive convention to be held in this City. I desire to express my gratitude to you for this opportunity and of having my name added to the list of Presidents of this important Association for the second time.



F. C. Pickard, Past-President

Ladies who are present, we desire to thank you for your presence and are very grateful to you for sharing with us this wonderful work. We are glad to have you with us.

I desire to extend my appreciation and thanks to the officers and members of the different committees who have put forth such strenuous efforts to make this convention one of history, by bringing out the very best papers that have come before us—the work of the Secretary and that of the Executive committee. The work of this committee in securing the data that has been prepared for you and to be read at the convention, is the result of untiring effort and team work to bring forth the same.

The Railway Supply Men's Association has again prepared for your inspection and instruction, a wonderful exhibit of railway appliances and locomotive specialties, which is a very important part of our Convention, and I am told that the number of exhibits is greater and the space occupied is larger than any previous convention. By the expense incurred leads me to suggest that you owe a careful consideration and inspection of these exhibits, and I desire to extend my thanks for this magnificent display.

In order that an opportunity be given for an inspection of the exhibits, it was decided at our last convention to re-arrange our program so as to devote considerable time to the exhibits, and that has been done by arranging one session for a day and then, Mr. Supply man, it is up to you for the remaining part.

To the members of journals who have done such wonderful work in the past few years in promoting shop efficiency and their assistance to this organization through the medium of their valuable papers, is very greatly appreciated, I assure you.

The work of the General Foremen's Association has been far-reaching, well defined and its benefits appreciated by all, and I feel that the work of this Convention will place it along at the top with the other Mechanical Conventions.

By a mutual discussion of the many subjects that come before the convention and the benefits gained by convention work, your attendance is profitable to yourself and to your Company.

It not only affords an opportunity upon the floor of the convention, but opportunities for exchanging ideas outside of the convention hall. We are able to talk to our many associates on various matters and be enlightened in progress that may have taken place to arrive at the results being obtained by our neighbors that took untold labor and experimenting to arrive at. You in turn may be able to offer something that may be a benefit to him.

The man who tries to keep all his own trade knowledge to himself should remember that he has no right to the ideas of others if he is stingy with his own.

As General Foremen we should be able to make an analysis of our local conditions and surround ourselves with the proper organization to meet the requirements of shop management. Organization is recognized as an economical necessity to effective control and co-operation in human effort. Organization deals with men and industrial organization includes the elements of production and transportation.

Some ten years ago a handful of men who were far-seeing met in St. Louis and laid the foundation for the International Railway General Foremen's Association. They accomplished a great deal in the railway mechanical field, and to you, gentlemen, also the railway companies whom we may have the pleasure to represent.

We would like you to make a very careful study of the various committee reports and you will see that they are the result of hard, earnest effort and thought.

They are matters with which the General Foremen are daily coming in contact. By a liberal discussion of the various reports, you will be assisted in arriving at your conclusions as to the proper way and the economical handling of these important matters.

We should consider carefully the recommendations that are placed before us and let us not lend the prestige of the Association to do anything that may increase maintenance in shop operation.

The conclusions we may arrive at as recorded in the minutes of our convention is the harvest we reap, and the benefits derived, the profit of our convention work. The improvement so derived in shop practice means necessarily an increase in output, which is always appreciated by our superiors. Be sure you are right and then command the courage to carry out your convictions and you will win.

I have been particularly impressed during my connection with this organization with the probabilities of promotion from the ranks of the General Foreman to one carrying higher responsibilities in the mechanical field. These men invariably have been active in the work of this body and owe their promotion to the activity in promoting the welfare of their companies by close attention to the subjects brought before them. You will find that the men doing the big things today are those who were yesterday doing the little things the best they knew how.

To you gentlemen who are the representatives of your railroads, make the most of your opportunities while here and be ready when called.

It is my desire that your attendance be profitable to yourself and Company you represent, and that you will go home fully repaid for the work you have done.

Recommendations.

That the subjects continue to be of shop operation, methods, etc.

That standing committees be appointed on machine work, erecting work and roundhouse practices.

Appointment of committee on resolutions. Announcement of entertainment. Announcement of trip to the Northwestern.

President Pickard: We have with us this morning our old friend Mr. Quayle, who will now address you. (Applause).

ADDRESS OF MR. ROBERT QUAYLE

(Supt. Motive Power and Machinery C. & N. W. Ry.)

Mr. President and Gentlemen of the Convention:

I have been told since I came on the floor that I was late, but I was not expected to be here, as per letter I received on the 9th inst., from Mr. Neeley until 11:30; by that, I am on time.

I assure you it is a pleasure to come here at this time, even though I had to leave another meeting to be here, and look into your faces and see there expectancy at least. Perhaps one of the points of expectancy is you are expecting what I am going to say, and another thing is that you are looking into the future with more or less degree of faith that by and by you will be more than you are today.

The gentleman who just sat down said, "The men who are doing the big things today are the men who yesterday were doing the little things, and they did them the best they knew how." That after all is the secret of life—the secret of success in life is to play well your part. One of the great writers has said: "The world is a great stage and we are the actors," and it behooves us, therefore, to act our part well, and when we do it with all the force and intelligence we have, there must be some kind of results.

In thinking about what I should say to you this morning I jotted down just a few head lines here, and my first thought is: "It is a good thing for men to get together." The Bible says, "Come, let us reason together" concerning the things with which we have to do, and when a number of men get together, it is not only the intelligence of one man, but the combined intelligence of all the men, that counts.

I said only a little while ago somewhere that by you men coming together, if you could only get the kinks that are in every shop, each man would bring one particular thing, and every man would get each of these particular things, he could go back to the place from whence he came and that shop would be awake for the next year. There would be something doing, by the things that were put in from other men. There isn't so much genius in this world, and we do not need genius as much as we do hard work. Apply the things you have and go after it. I think I have made use of this a number of times,—somebody said to Thomas A. Edison that he was a genius; he must

have an inspiration. He said: "Yes, two per cent inspiration and ninety-eight per cent perspiration." If we would work a little harder and perspire a good deal more, I believe that the results we obtain would show many times more than they are now showing.

I say it is a good thing to talk things over. Every business man takes an inventory at least once a year of the stock on hand, and when he takes that inventory it gives him an idea of how he has progressed in the year gone by, and when he looks over the things that he has not sold he finds that somebody has made a mistake in buying too much of that material that he did not have any use for. And so you foremen simply take an inventory of what we have accomplished. That may pertain to character as well as shop results, but if we take an inventory once in a while and say: "What have I got that does not mean anything; why did I do it?" We can ask ourselves that question with a good deal of force. Why, why did we do it? I think we do a good many things without asking the reason why. We go on and do it.

Somebody says: "We did that 25 or 40 years ago, and if it was good enough then, it is good enough now." You cannot live in the past today. If you do you want to cut your spring hangers and go into the woods and stay there. You have no place in railroading, because if there is any place that needs applied mechanics and applied intelligence, it is on the railroads where we are carrying so many passengers all the time, and your intelligence put into action might save some lives, and we ought to think about these things. We do things haphazard—slovenly—sometimes,—some of you,—and it may be that I am talking to some fellow who may be in the habit of letting somebody else do it, and if you are responsible for that man you are just as responsible for the action as the man; if you know he is that kind of a fellow and does that kind of a thing so that it may result in an accident, you are just as responsible as he. It behooves us to have every man line up to do the very best that he can.

I want to thank your president for that suggestion this morning. You see I am using it.

You come here and you have a number of good papers. I have looked over several of them. There are some very good suggestions. Study them carefully, then go back to your homes and say: "Now I will begin to do something along this line." And if you don't you might just as well have remained at home as to come here. It is not what you know; it is what you do that counts. Then let us be up and doing. Let us do the things that we know we ought to do and everlastingly keep at it.

If you go to your places at home, and, as I have suggested, put into practice the things you have seen and heard here and talked about here, the railroads, and the general public, and the community in which you live and the great nation at large will receive the benefit.

I was thinking as I came over from my office that high speed steel has had very much to do with the progress that has been made in shop practice the last few years, and as I thought about it I thought that sometimes we get a little careless, and it becomes so common to us that we think we have had it all our lives and we do not appreciate what it is, and when a thing begins to be in a sense unappreciated by us we begin to lose interest in it and we lose the application. It was all right when we used to feel that we could cut up a piece of steel in a lathe and turn it at from 14 to 25 feet a minute and now when we can get from 65 to 125 feet a minute we say "that is all right on that job," but how many of us are studying the situation that we might further employ that steel for other uses that we might thereby make the machines that we have incapable of doing the work. I use that word advisedly. When we first began to use high speed steel the first thing we ran up against was: "There is not power enough in this machine to use it as I would like to use it." And then man began to get busy. Man is the chief factor. There isn't any machine that man has made that is his equal. He began to get busy; he makes it stronger; he makes it more capable of getting out more work in the same time. Then you say: "I have got my machine; I can apply this steel," and you look for other worlds to conquer, and apply it in some other direction that will increase the output of the shop.

It is not so much the idea that somebody will notice you and put you in some other position, but because you think it was right to do it, and because you love to do it, and because your self-pride and your ambition compels you to do it, and when you do that without any thought of anybody else, somebody comes along without even touching your shoulder, and, as I have already suggested, you are picked up from there and moved to a higher position, and then you see what did it. Why? Well, maybe you don't know, but there were other eyes that were looking around for men to fill this position, and they found you right there and they took you. Keep it going on this line and it will be your turn next.

How about the progress of the man? We talk about the progress of machinery. We are building ponderous locomotives; we are putting on superheaters that we may raise the temperature of steam and have it at a higher degree Fah.,—make it more elastic and more efficient. Getting it further away from the point of condensation.

We are constantly studying about these things, and we ask how quickly can we get the old locomotive fitted up with superheaters, so they can do better work or save some more coal, but we are not considering very much about the man. We should give more consideration to the man; he is the one that creates, and we should give him more thought and more study.

There are certain lines on which men can become better men; they can be more useful in the community in which they live, and more useful in their own home; they can be more useful in the field of labor in which they are exerting their efforts, and it behooves us to assist the men to attain to higher standards in every way.

We are going along with some kind of a peculiar swag about us and we think we are the whole thing, because we have got some position. But if we will stop to ask ourselves: "Who am I, and what am I, and how important am I," and then take up a few well-chosen volumes and read them and find what other men have done, and I will tell you what you will think. You will want a knot hole to crawl through; you will feel so insignificant and so little. That is a splendid way to feel. Let us begin to feel that we do not know very much. When we get that idea in our heads, then we are in a splendid position to try to learn something and to be somebody. I used to get that notion when I was a youngster, and maybe I have got it now more than I ought to. I used to think I was the whole thing,—a whole show in myself. I had that taken out of me a great many times. My mother was one of the principal factors in taking that out of me. Do not applaud yourself; if you are all right the world will applaud you, but do not attempt to do any of it yourself.

What are we doing about these men? We all have brains, good hands and eet. What are we doing with them? In the lines in which you and I move, are we applying them with all the intelligence we have so that by and by they will begin as we are, sowing the seed here and yonder. We begin to gather the fruits. It is not out of place to look for fruitage. I have no compassion for a man who will sow the seed and not go out and see how it is coming. We should constantly check ourselves up as to what we are doing, and if we are getting good results, we should encourage the men that are getting such results for us.

Encouragement makes for larger efforts, and larger results, and the larger results gives to each man a wider horizon to look out upon then you can begin to feel that the men who are with you, and about you, are factors in the race with you, and the less importance you attach to yourself the more importance you attach to the other fellow who is associated with you in your work. And when you think the other fellow is important you take him by the hand and help lead him to a higher strata in life. What is the result? That fellow is your friend, and instead of going alone there is another fellow going with you, and that applies all down the ranks with every man you have. It is a very good thing to have all these men coming our way. That is one of the ways that we can make progress, and you are one of the factors in life to help these men make progress that way. Will you do it? I will leave the question with you.

General Foremen—what shall I say—are some pumpkins. General Foremen hold an important position. You are the leader in your line. You

are the leader of the work. You are the leader of the men. Your influence means a good deal. Your intelligence ought to mean a good deal. Sometimes we think that as one man we cannot do much, but one man can do a whole lot and we ought to determine that we will do the best we can and have things coming our way.

I have one little line here and it is this: Are you a good instructor? There is a good deal in that. You have had some teachers in your time that could say something to you or ask you a question in a cynical manner that would stir up all the ire in you and you would resent it. He made an impression but it was not a good one. He did not know your disposition. If you have foremen under you, you ought to know their dispositions. You ought to be able to teach them without touching him under the lower rib, and you are not a good instructor if you cannot do it. You may have some men that you cannot treat that way, and if you have the best thing is to relegate him to the rear, because you must have harmony, and you must be the leader to work with them and get them to work with you. If you do that you will have a very good knowledge of the men who are associated with you in each department. By and by somebody higher up is looking for a man to take some important job. You may be the fellow he has his mind's eye on, but you are filling such an important position that the fellow next to you in the shop—he is not as good a man as you, not nearly. He says: "I can't take a chance on that. I am not going to take a man out of that position and lift him up a notch higher until we have somebody here in the ranks that will take his place. Some of us sometimes feel that it is not a good thing to have that kind of a man right next to us. We get jealous and afraid that he will get our job. Jealousy has no place in a workshop, nor any where else. I want to tell you that the man who succeeds in getting men who are in every particular better men than he is, will succeed, and if I cannot get a man for my associate who is a better man than I am I wouldn't have him. He must be a better man than I am in every way. At least I must think so, and when I have him there what does he do with me. I get a force and support around me then that is as staunch as the very Heavens above. Let us get men about us that we know are our superiors. That is not reflecting on you either when I say it. If I have a man who has good men about him I know he has the fellows that are doing the work.

Have you your eye on good material, on good men,—all the time to fill the positions that are becoming vacant by men who are being moved up or leaving the service? Have you got it down some place "John Jones and James Brown", and get them up according to their ability to do things. You ought to have and I have no doubt you do have. Don't you know it is the hardest thing in the world for men to pick out men to fill the positions higher up? A good deal of training is necessary and you men ought to have these men down at the beginning that have the intelligence, that have the moral fitness, that have the mechanical fitness. I said "moral fitness" and I want to tell you that you do not want to put any man into a position of trust who is over a lot of other men, unless he is a clean man.

I said to my chief clerk yesterday: "Mr. Seavert, what would you suggest that I say to the General Foremen's meeting tomorrow?" He said: "I don't know." Then he looked at me wisely and he said: "What about lost motion?" That is a word that appealed to him and appealed to me. In these days when we have these large locomotives, when we have such heavy reciprocating parts and we have to have such heavy rods,—large crank pins and other large reciprocating parts, it means that we are constantly carrying around in this manner tremendous loads, and when we are using tremendous power up, the engine exerting it through the force of the steam on the piston, when she comes around there if there is any lost motion it is a thud, and each one of these thuds, used in the sense that I am using it, which you can understand, is going to make for more lost motion, and it is going to be communicated to all parts of the engine. You understand that that lost motion ought not to exist; that by proper supervision and good workmanship that ought to have been eliminated before that engine left the terminal. And if it ran smoothly and all the lost motion taken up; then your shoes and your wedges,

W. W. Scott, President

driving boxes, main rods, brasees and all the rest of the things that go to make up the motion of a locomotive will work smoothly. You know that.

You would say to me if I should ask you anything like that: "What we need is sufficient men in the round house that we might be able to take up that lost motion and keep it up. But we cannot do it with the force we have." We will agree that it ought to be taken up. There are lost motions in other places than in the one I have just mentioned. No doubt about that. The Superintendent of Motive Power sits up in his office and looks over his expense account. And he says: "My pay rolls in my shops and on the road are approximately one million dollars a month; it is pretty big. My cost of repairs are so much per mile run, or so much per thousand miles," and then he begins to say: "Why does it cost me so much?" And then the Locomotive Engineer and some others like my good friend to my right here (Dr. Sinclair) calls our attention to just what it cost last year, and they want to know why it cost us so much and why some other roads do it for so much less, and we have got to think about these things and we must get busy. Then we begin to look around for the lost motion. We begin first to question right at the head of the department: "Who am I; what is my authority; what am I doing; what is my material costing me as compared with last year; what per cent has my wages increased; how much has my labor increased on account of the larger parts that we have to handle; what have been the conditions on the road; has my tonnage been equal or has it been lower which would increase my cost?" We are prone first to find fault with the other fellow, and I will guarantee you from personal knowledge that it does not so much belong to the fellow up in the shop as it does to the fellow up in the office. You might spend half a thousand a month down there but it would not reduce the cost of them so much as it might in the other direction, but like the little drops of water that made the great rain storm that we had last night, it all helps, and we have to go into the various avenues and search for the cause of the excessive cost, and then we go down to the shop, and we find a man going around and he may have his two hands far down in his pockets and he does not see very much of what is going on around him, but he sees us coming and he will say: "Here is the old man" and then they get busy.

You see another fellow going down the shop and he is just going fast enough for somebody to notice him. That fellow has a good gait and a good carriage; that fellow's head is up in the air. Not so far up in the air that he has to look over the tops of the other fellows' heads. He passes this fellow and wonders if somebody has put salt on his work to keep it fresh. The General Foreman says: "What has been going on here? Haven't you got a time limit on this kind of work? Yes, what is it?" This is the General Foreman; I am just impersonating him now. "I haven't anything to do with that." He calls the foreman's attention to it. The General Foreman says: "You got to get 10 hours' work for 10 hours' pay and if I don't there will be something doing and he goes away, and he does one of two things: He (the foreman) either agrees to resign or he agrees to make good. I want to tell you men we all like to make good, but you can do it in a kindly spirit, and it must be done in a kindly spirit because if you do not, we will lose out. You will lose out. Take up the lost motion everywhere.

You may have a little machine over in that corner doing a certain kind of work on it that has another operation to go through on another machine over in this corner. Take up the lost motion. Take that machine over to this machine or move the other over here. The transferring of work from one corner to the other extreme corner costs money. It costs time and we cannot get labor for nothing. Assemble your tools so that a minimum of movements is required to get the different operations complete.

I have another note here. If I were asked by a young man—I see a lot of young men, but age is simply a matter of how old you are yourself. When I was a boy about 10 or 12 years of age, I looked at the fellow 25 and I thought he was awful old, and when I got up to 25 I looked at the fellow 40 and thought he was an old man, but now since I got up to about 90 and I look at the fellow 100 or 120 years, I do not think it means anything. He is only a young man. But if a young man were to come to me and ask me how to succeed, do you know what I would tell him was the first essential to success?

I want you to listen to this. You might say a good technical education. I would not. That is a splendid thing. You might say a fine physique and good health. I have had that all my life, not such a fine physique as good health. My physique is all right of the kind, but it is a very small kind. That would be a good thing, and I might name a good many other things, but the greatest thing for us to cultivate is character. CHARACTER, and I want you to spell it with capital letters. Character simply goes out from you in every word that you speak and indicates the kind of man you are. It will be reflected today in the work that you do. It is reflected in your conversation; it is reflected in your home; it is reflected in the community in which you live—the kind of character you have—the kind of man you are, and don't we all like to be the best kind of man we can be?

We say sometimes: "What do we care about public opinion?" What would you do without it? You could not go to a bank here and open up an account unless they have confidence in you. Not me. Not you. If you come to my office and you know who I am and what I am and I say: "Yes, I will do that." If you know me to be right,—not only me but anybody else —Brother Sinclair, if he makes a statement in his paper and it is over his name, you know it to be right and you know he is not catering to anybody, and you know, when I say to you: "Yes, I will do it," the old man said he would do it and that settled it. That ought to be as good as law and that ought to be your position and your attitude in life, in your home, and in the shop, on the street and wherever you are. And that character will bring confidence, and that confidence will get results and the results lead you and through it you become important, and that importance then is attached to your family, and your wife—she doesn't say anything but she looks wise and she says: "That is my husband," and she is proud of you. Do you want your wife to be proud of you? Be a better man than you are a General Foreman. Have a better character than you have ability to do things, and when you do that, not only the community but everybody else will say you have done well. The men in charge will say like the Lord over all: "You have been faithful over few things, I will make you ruler over many. Come up higher." (Applause).

President Pickard: Ladies and Gentlemen, and Mr. Quayle:

Permit me to thank you in behalf of this association for coming amongst us again. It has been my pleasure to attend a great number of conventions during my career in the North and South, East and West, and Mr. Quayle, when I say to you that your talk this morning has been the greatest inspiration that I ever received and I say it with all sincerity. The highest tribute that we can pay you this morning is to give you a rising vote of thanks, which I offer from this convention to you. I thank you.

Thereupon a rising vote of thanks was tendered Mr. Quayle.

Mr. Quayle: I thank you, and now if I may be excused I have another meeting that I must attend.

After a five minutes' recess affording the ladies an opportunity to retire, the Secretary-Treasurer read his report as follows:

SECRETARY'S REPORT
1912-1913

Winona, Minn., July 15, 1913.

To the President, Officers and Members of the International Railway General Foremen's Association:

In accordance with the usual custom, I hereby submit my report of the membership, also the receipts and disbursements, from August 1st, 1912 to July 15th, 1913.

Total active membership August 1st, 1912	187	
Suspended for non-payment of dues	34	
	153	
New members added	22	
Total active members		175

Associate Members.

Membership August 1st, 1912	33	
Suspended	1	
	32	
New members	1	
		33
Honorary members		6
Total membership		214

Receipts and Disbursements

RECEIPTS

Notes payable	$600.00	
Received from L. H. Bryan	143.58	
Refund	2.25	
Dues	120.00	
Application fees	110.00	
Advertising	729.70	
Total		$1,705.53

EXPENDITURES

Printing 1912 Proceedings	$550.00	
Secretary's salary	300.00	
Secretary's fees	22.00	
Postage on Proceedings, etc	62.71	
Typewriter	40.00	
Printing and Stationery	43.89	
Incidentals	14.00	
Expressage	6.33	
Stenographer	23.50	
Total		$1,062.43
Balance on hand		643.10

On motion the report was received.

The following members were asked to serve on the Auditing committee: Messrs. Logan, Chapman, Hobbs and Cuyler.

President Pickard: The convention will begin in the morning at 9:30. Superheated Locomotives will be presented by the chairman and his associates and I hope all of you will be here at that time.

And thereupon the convention adjourned.

WEDNESDAY MORNING SESSION

President Pickard called the meeting to order at 9:15 and called upon Mr. Scott to read the paper on Superheated Locomotives, in the absence of Mr. Lincke.

Topic 1—Superheated Locomotives, by P. C. Linck, 1106 E. Seminary St., Danville, Ill.

1. In the designing and building of locomotives, the superheater appears to be the most important, and valuable improvement applied to locomotives for years. It is claimed to effect a saving of 25% in coal, 35% in water and increase the horse power or hauling capacity about 33%, while the cost of maintenance is comparatively little greater than saturated steam engines.

2. One of the most important items in maintaining superheater locomotives for successful operation, is to keep the flues and superheater units clean. To obtain the best results a special man should be appointed to clean the flues, remove the clinkers or honey-comb that may form on return bends at fire box end, the crown sheet and the brick arch, (if the engine is equipped with brick arch). He should be held responsible

that the engine is not allowed to go out without being thoroughly cleaned. For cleaning the flues a $\frac{3}{8}$"gas pipe long enough to extend entirely through the flue should be used. This pipe to be inserted at the fire box end and gradually worked forward to the front end of the flue under the superheater unit, blowing the dirt off the front end of flue.

3. The flues should be given close attention, if leaking or they need re-working, the prosser expander only should be used, if the roller is used, it should be done carefully, as it tends to force the bead away from the flue sheet. If some of the beads are away, a standard beading tool should be used to tighten beads to sheet. Rolling also has a tendency to stretch flue sheet holes and put strain on bridges between flue holes.

4. At stated intervals, the superheaters should be given a test with warm water at a pressure of about 100 lbs. If convenient, make this test correspond with monthly stay-bolt test. This test to include the boiler, seams and flues in front flue sheet should be carefully examined for leaks, all joints in the superheater steam pipes, rings, exhaust pipe, all joints to steam header, also for cracks or break in header, and the unit pipes just below the ball joint, as I understand on some roads this is where the most trouble is experienced. We have the most trouble with the return bends leaking at fire box end. These should be thoroughly inspected and the slightest leak repaired before the engine goes into service.

5. On one type superheater we have had trouble with steam pipes leaking, considerable of the trouble was due to the rings made of brass, they seemed to deteriorate very fast, we have changed these to a good grade of cast iron; we also found the joints were not made perfectly, the joints would be faced then ground in with air motor; they were probably ground too much, as they would appear to be a good fit, but on laying a straight edge across, they would be hollow inside, if ring was not put in exactly central it would be on a strain, and leak in a short time, by seeing that joints are perfect and by using cast iron rings we have overcome most of this trouble.

6. We have experienced some trouble with both types of superheater unit pipes, and return U's leaking where fitted together, generally at back end, but a few at front end, to make temporary repairs on the one type we plug the front end, but if left plugged too long, the back end will burn off, account of having no circulation through pipe, as soon as practicable we remove the pipes that are leaking, repair, and test before replacing. These can be removed without disturbing the steam pipes on the outside ones, the boiler front has to be removed. We made a special flue cutter for cutting off superheater unit pipes at steam pipe connection, and rolls for applying as a regular flue.

7. The other type we have had very little trouble with steam pipes leaking, if the superheater pipe joint leaks at header or one of the return U's, to make temporary repairs we use a dummy coupler furnished by the Superheater Co. But as soon as possible we repair the pipe and test to see that return U's do not leak, we made a tool for testing one unit at a time, we used a piece of brass, making ball joints one side the same as on header and pipe connection on opposite side to apply the test. We had male and female reamers made so as to keep all joints standard and to make formers, these formers are made to fit air motors to be used in grinding the ball joints, on receiving general repairs or when some of the superheater unit pipes have been out, we apply a hot water test and tighten all joints again after test. If any new pipes are applied care should be taken that they are right length from header to bend, so they will be close to top of large flue, that heat and gases may circulate freely around pipes.

8. We had considerable trouble with the valve bushings, valve packing and cylinder packing on the first superheated engines. They were a Pacific type passenger engine equipped with Emerson superheater, 175 lbs. boiler pressure, 13" valve, 25½x28" cylinders, placed in service October, 1910. Part of this trouble was on account of men not familiar

with the best way of handling the manner of lubricating, and a great part the fault of metal used in these castings. The best quality of cast iron should be used for those parts; we have adopted the Hunt-Spiller gun metal iron for all cylinder packing, valve packing, and bushings, and steam pipe rings. We have very little trouble with valve packing since, we make the valve packing $\frac{1}{8}''$ large, cut out the proper amount, then have a jig for compressing together and turning off exact size of valve chamber. The later superheater engines were equipped with a semi-plug piston valve.

9. The piston heads seem to wear very fast, partly due to the weight of head, riding on cylinder. We have none equipped with the extension piston and it is a question, if it would be economical to apply extension piston and maintain it or to renew the heads every 8 or 9 months. We experimented by trying a composition of copper, lead, tin, zinc and antimony, applied to the bottom of piston head. We have it running on some of the engines for five or six months and it is giving good service. On one engine that had worn cylinder and piston head $\frac{5}{16}''$ we applied this composition to piston head, three months afterward it showed $\frac{1}{16}''$ wear of the metal applied.

10. The question of lubrication of superheated engines is one of the most important items. There is considerable discussion upon using a high grade of valve oil, that would withstand the heat before burning, or carbonizing. Quite a number use, and it has been recommended that a special grade of oil be used for superheated engines. This company has made no change, using the same grade of oil for all engines. We have made a few experiments and tested out different theories. One test was to attach a long copper pipe to lubricator on test rack, coil the pipe, and put in a forge at coils, heating to a red hot heat, letting the lubricator feed oil through the hot pipe, the oil came through heat in as good condition as it did when pipe was not hot, the oil being kept from burning by the steam as they both flowed through the pipe.

11. The first superheaters had a five feed lubricator, one feed to air pumps, one to each valve, and one to each cylinder. After the engines were running awhile, and we were having trouble with valve and cylinder packing, we connected a steam pipe from boiler into lubricator oil pipes that the engine while drifting would have a flow of staurated steam with the oil, to try to keep the oil from carbonizing, and to help lubricate the valves and cylinders with saturated steam. The engines received a year later were ordered with the booster valve applied to lubricator. On some of the engines we found the oil pipes from lubricator trapped or running up hill at boiler head slightly, instead of a direct and gradual fall from lubricator to valves. We tested this out on lubricator test rack, running a long oil pipe from lubricator to steam pipe, we connected a water glass into oil pipe at each end so we could watch the oil as it passed through with a gradual fall and without back pressure of steam, oil would flow through quickly, and evenly with it working against back pressure or into steam of the same pressure, it would take ten or fifteen minutes for oil to reach end of pipe, showing that lubricator should be started before throttle of engine is opened, to partly overcome this, oil plugs at steam chest are choked to $\frac{3}{32}$ or $\frac{1}{8}''$, when oil pipe is trapped or are inclined up slightly, the oil would stop at this point until water has condensed in pipe, then the oil would all go at once, the valves, therefore, receiving the oil irregular while they should receive a small but constant supply of oil.

12. Another theory we have is to have the oil enter the steam as far away as possible that it may atomize and be thoroughly mixed with the steam, before reaching the parts to be lubricated. In our experiments I believe it had proved correct; on this theory we removed the oil pipes leading to the cylinders, and only used the feed to each valve. All the new engines purchased since, eight Pacific type passenger engines, 13″ valve, 26½x28″ cylinder, 185 lb. boiler pressure, 25 Mikado superheater freight engines, 13″ valve, 28x30″ cylinder were ordered with only a

ATTENTION

The Secretary earnestly requests all members to write him at least once each quarter, giving full name, P.O. address, Railroad by whom employed, also position they hold.

The Secretary wishes to impress upon the minds of the members, the importance of keeping him posted of any change in address, or position; this to enable him to keep accurate record of all members and that any communication addressed them may find them without any delay.

three feed lubricator, with booster valve attached, we have had but comparatively little trouble with these engines.

13. On October 1st, 1912, we put in service a Baldwin balanced compound engine that we had just given general repairs, and applied a superheater, the high pressure cylinders are 16x26″, low pressure 26x26″, and the piston valve 15″ diameter. This valve is one casting, but acts as a double valve, admitting steam to high pressure cylinder and exhaust back through it to low pressure cylinders, one valve and packing rings weigh 412 pounds, there are 12 rings on each valve. There was a question as to how to lubricate this engine; it was recommended to use a seven feed lubricator, a feed for each valve, each cylinder and air pumps. We started the engine out on the theory to have the oil enter steam as far back as possible from parts to be lubricated, that the oil may be thoroughly atomized and mixed with steam before reaching valve, we only used one feed from lubricator to each side of engine. We drilled holes high as possible in cylinder saddle wall to steam cavity, and made long oil plug to reach to center of steam cavity.

14. After engine had made several trips we examined and measured the size of each cylinder and valve, the engine was well lubricated, but the least lubrication was at first admission to valve, after it had passed through high pressure cylinder, back through valve, into low pressure cylinder, there was more oil, and better lubrication, the center of lower pressure cylinder seemed to be the best lubricated. We changed the oil pipe plugs to get oil further back from valves. We drilled hole through smoke arch into steam pipe in front end, and put oil plug into center of steam pipe in the center of smoke arch. The engine has been in heavy fast passenger service and is doing excellent work with very little trouble. In December we applied National Graphite Lubricator to this engine, the valves, etc. being very heavy, it is expected to reduce friction, wear, and handle easier, therefore use less fuel.

15. We had superheaters applied to several Pittsburg cross-over compound engines, they have piston valve on high pressure and slide valve on low pressure cylinders. They have a four feed lubricator without the booster valve, we attached a steam pipe direct from boiler to lubricator oil pipes. We removed the oil pipe from intercepting valve and put it on high pressure side through smoke arch into steam pipe, expecting the oil when engine is working simple to go with steam direct to intercepting valve, when working compound to go through high pressure valve, cylinder and receiving pipe, to the intercepting and separate exhaust valves. The high pressure steam with oil admitted to it, would be in contact with part of the intercepting valve. On trial one part of the intercepting valve did not appear to receive enough oil. We put a tee in the low pressure oil pipe and run it to intercepting valve, it receiving part of the oil from the low pressure valve oil pipe, the low pressure receiving part of the oil with the exhaust from high pressure side.

16. We had trouble with piston packing melting on high pressure side of these engines. The composition of the piston packing was changed, and by-pass valves applied to the high pressure side of the engine, expecting to relieve any excessive compression. These engines originally had these valves but were not used for several years, they are giving comparatively little trouble now.

17. On receiving general repairs, flues or steam pipe work on one type, we remove the steam pipes and superheater unit pipes together, we have a boiler plate bracket to fasten and hold the pipes in proper position, handling them with the electric crane, they are repaired and joints made on steam pipes and given a hydrostatic test of 250 lbs. They are then handled with crane and replaced in engine. After all joints are tightened we apply a water test to see that all joints and connections are tight. The other type we handle one unit at a time, each unit is tested separately; we have a tool which we mentioned before that we connect to unit pipes and apply a water and air pressure of 200 lbs. Where one or two unit pipes are broken below the ball joint, it is the practice at some places

to splice the pipe with a steel coupling, making the ball on short piece of the unit pipe in the Smith shop, on a die similar to a bolt header die, afterwards finished to proper size. We have applied the ball end to new unit pipes in this way, finishing on turret lathe to a standard former for ball joint. We have just finished welding with acetyline a set of return bends on the fire box end, at time of this writing. The weld stood the 250 lb. hydro. test, and made several trips on the road, with no defects developed yet.

18. The units should be provided with supports and bands to replace any that have been lost or damaged; units 18 ft. long or over should have two supports, the first 6 in. from back end and the second midway between the first and the end of the straight portion of the unit. Unit bolts should be examined and replaced if not in good condition. Whenever units are removed from boiler, the tube supports and bands should be inspected and replaced by new ones if not in good condition.

19. We have made quite a number of small special tools, the formers for grinding superheater header, and unit pipe ball joints, we found gave the best service made of copper. We have reamers for these, so when they are worn or not standard, all that is necessary is to use a reamer to keep the formers standard. We made cutter for cutting large holes in flue sheet, a ball reamer for removing sharp edge after cutting the holes, a roller for copper ferrules in back flue sheet, rolls for applying unit pipes on the Emerson, rolls and prosser expanders for working the large flues, machine for cutting all size flues, gig to hold steam pipe rings, to be ground with air motor, one for drilling and reaming holes on superheater header, standard gauges to keep all beading tools, prosser expanders and ball joints to a standard. These should be carefully checked as an odd size beading tool or prosser may do considerable damage to the flue or flue sheet.

20. In renewing the flues at first we had to take the large superheater flues to the pipe shop, have ends cut off in pipe machine, back to boiler shop and weld on safe ends, back to pipe shop to cut right length. To avoid transferring, and to expedite the work, we had the flue cutting machine remodeled, the old machine worked with hand screw feed for cutting flues, we had new machine made with air cylinder to feed cutter through flue, also a clamp or steady rest to hold other end of flue while cutting, this operates with air, they are both operated by one foot pedal located about the center of machine, so the operator does not have to move from center of machine in handling the flues. The welding machine was changed slightly, and new mandril made for welding the large flues. The flue plant is arranged so flues pass through with one handling, they are rolled out of cleaner on short inclined rails to flue cutting machine, passed on to furnace, then to flue welding, safe ends welded on, passed on to next flue cutting machine, and cut to rail length, passed to hydro pneumatic testing machine, tested at 250 lbs. pressure, then to grinder to have scale and burr removed, then loaded on car or wagon for delivery to engine or shipment.

21. In removing flues from boiler, the front end should be cut off as close inside the sheet as possible, the back end should be cut far enough to free it from prosser marks, or if safe ends have been applied they should be cut off to remove the old weld, maintaining only one weld on the swaged end of the flues. In cleaning the flues, care should be taken that there are no rivet heads or projections inside the rattler, the large flues are considerably heavier than the 2″ or 2¼″ flue, therefore must be handled more carefully, and any projections will dent the flues or cause the ends to start to crack, making it necessary to cut considerable off the flue in order to square up the end, or if dented and the dents not removed, it will make it difficult to insert the units in the flues.

22. The safe ending of the large flues is to be done at the fire box end, rather than smoke box end, this provides new material where service conditions are most severe. It is recommended that the safe end be an-

nealed after applied, in order to prevent liability of cracking and permit it being worked more easily in the flue sheet. When safe ends have been applied so that all space has been utilized, between flue sheet and return bends, the flue should be reswaged, and a long safe end or extension applied to the front end of the flue, being careful to leave it smooth with no obstruction, on the inside of flue, that would prevent or make difficult to insert the units into the flue.

23. In welding $4\frac{1}{2}''$ tubing it is a good practice to scarf the safe end for a distance of about 5-8" and heat the end of the flue bell-mouth it and insert the safe end while the flue is hot. This practice insures the piece sticking in the flues in proper place until it is heated and in position in the welding machine. It may be found in attempting to weld the large flues, that trouble will be experienced in bringing the material down at the point of the weld uniformly to the thickness of the flue. The scarfing of the flue tends to lessen the difficulty experienced in bringing the metal down. It is important that the welded portion of the flue be smooth on the inside, thereby removing all obstructions and facilitating the cleaning of the flues.

24. On account of the weight of the flues, there may be some difficulty experienced in handling them. A heavy flue rest should be provided at the back of the welding machine and furnace, equipped with a spool or thimble, the same to be subjected to adjustment so that the flue may be uniformly supported and kept in line with the mandril and the furnace and the welding machine during the time that the heat is being made and the welding operation carried on. The difficulty in safe ending large flues may thus be readily overcome by the proper methods of handling, heating and a machine designed to do the work satisfactorily.

25. Among the general difficulties experienced in tube welding, in the past, has been the use of the improper dies, particularly if used on hammer welding machine; on roller machines, rollers not properly adjusted, thus preventing the necessary pressure on the material, which must be obtained to secure a good smooth weld. Another trouble has been furnaces that do not heat fast enough, the result being an excess amount of oxidation or loss of material; furnaces where the heat is too harsh and the action of the air blast too severe on the material, resulting in a loss of material before the flue is ready to be taken from the furnace. Good flue welding demands that the flues and safe ends be heated in a furnace that gives a soft non-oxidizing heat that will heat the material uniformly to a good welding heat as quickly as possible.

Installation of Superheater

26. In placing the header in the front end, it should be so set that the face will parallel to the center lines of the top row of flues, and each end of the face the same distance above center line of outside flues of the top row. The header supports should be securely bolted to smoke arch to hold header in proper place and made so that the header will bear upon them throughout its entire width.

27. Care should be taken that the flue sheet is laid off the proper distance from the center of dry pipe flue sheet hole, and equal distances across, that it corresponds with header, and that units rest near the top of flue when they are tightened in place, that they may have free circulation, and flue cleaning pipe will go under the units. If the joints on pipe do not pull up true to correspond with holes in header, they should be bent or sprung in place and not be allowed to drag in place by turning up on the nuts. When the units are in place and tightened, they should be in the upper part of the flue.

28. When everything is tightened in place, apply a water test with 250 lbs. pressure. After boiler has been steamed up and superheater tested with steam, the bolts should be gone over and tightened finally. Suitable wrenches should be provided that will reach all unit bolts. These wrenches consist of a single socket wrench made to fit nuts and clean

unit pipes. With an extension long enough to allow a bar to be used in turning it without interfering with the units and short enough that it may be used without removing the table plate or damper. A peep hole should be provided in the side of the smoke arch to permit the inspection of the front end flue sheet, superheater units and ball joint connections without removing the baffle plates.

29. All superheater flues should be beaded in front flue sheet. The baffle plates should be made to fit tight and should be so constructed that they can be removed without removing the door ring. The damper when connected to steam chests, should be put up so that when weight is down the damper will be closed, when the weight is raised the damper should be open. When connected to the blower, its operating is reversed. Care should be taken that it operates freely.

30. On the road it is recommended to carry a level fire, as thin as conditions will permit, and endeavor to maintain a bright white fire over the entire grate. Do not carry more than two gauges of water, dry steam should show at the third gauge, working on level track. Exceptions are permissible where the engine foams, this should be reported at terminal. The throttle should be slightly cracked when drifting, so that the steam can carry the oil to the valves and cylinders as well as prevent air from entering cylinders.

31. The lubricator should be started ten minutes before leaving time at terminal, and should be fed regularly and constantly while running. About 25% more oil should be used with a superheater engine, than a saturated engine of the same size and in the same service. In running a full throttle is recommended wherever it is possible. The reverse lever should be cut back to permit the use of the full throttle until the most economical point of cut off is reached, which is about 25%. If further reduction of power is required, it should be obtained by throttling the reverse lever remaining at 25% cut off.

President Pickard: You have heard the paper read. The question of the maintenance of superheated locomotives seems to be a live subject, and as your humble president stated before, people who are stingy with their own trade knowledge cannot expect much from the other fellow. I want you to take the paper as you have heard it read and tell us your views so that you can benefit your neighbor as he can you, by the way you are maintaining the work in your particular class. To open the discussion I will call upon Mr. Logan.

Mr. Logan: You are unfortunate in calling upon me. While the Northwestern has a great many engines, I am so located that I do not have any practical knowledge of the same.

President Pickard: We will call upon Mr. North.

Mr. North: We have 200 superheated locomotives, fifty of the Pacific type and fifty of the 23 x 30 switch engines.

I notice in paragraph 3, Mr. Lincke called attention to the expanding of the flues with the roller. I do not believe we could get the life out of a flue with the roller that we could if only the expander were used.

In paragraph 4, I would like to know for my own information who handles the superheater, whether by a machinist or pipe man. In talking it over I find it is very much split up.

In paragraph 8 I notice that he says they make the valve packing $\frac{1}{8}$ of an inch large. I do not agree. I think it should be $\frac{5}{16}$ to make the rings and rod fit.

In paragraph 9 I notice he also states that they have none equipped with the extension piston. We are putting the extension piston rod on the same as on the Pacific and it has given good satisfaction. We use a regular superheater oil furnished for that purpose.

In paragraph 14 I heartily agree with Mr. Lincke as to graphite lubrication. We have tried it and it has given very good service. We have experienced very little trouble with the piston rod packing on the road.

In making the repairs to the units, we have been upsetting the tubing in the blacksmith shop, cutting each end of the unit and fastening together with a coupling made of steel tubing that has a right and left thread. It seems quite a saving.

In regard to welding with oxyacetylene, I am very much in favor of it, and I think the repairs can be made cheaper than they can by putting in a coupling with the right and left thread.

Referring to paragraph 20, our tubes are cut in the boiler shop. We have a special machine for cutting off the tubes and we have a home made affair for sweating the tubes on the small end which works very satisfactorily.

In regard to taking out the dents, we have a ball welded on a rod the exact diameter of the flue and we drive it back and forth through the flue to straighten out any imperfections that may be in it.

In paragraph 26 I notice that Mr. Lincke thinks that the heater should be securely bolted. I believe that is very important. If you get a very heavy casting you have a small surface to bolt to. I do not agree with Mr. Lincke though, in regard to plugging. I do not think it is good practice. I think where you mend a broken or cracked unit, it is cheaper in the long run to take the unit out. You have so much work to do anyway in order to plug it up, and it is a paying proposition to put in a new unit. With the large sized cylinders I do not think the supply of steam furnished by the unit is any too much to take care of what is handled by the engine.

Mr. Dickert: We have twenty-one and my experience with superheaters has been somewhat limited. We have six Pacific passenger engines put in service in May, 1912, and I have prepared a paper on what we are doing.

The middle of May, 1912, we had delivered at Macon Shops six Baldwin Pacific type engines equipped with the Schmidt Superheater. Cylinders 23 x 28, wheel centers including tires 69-in., five feed Chicago lubricators, also flange oilers manufactured by the same people; Walscheart valve motion, piston valves, extended piston rods. The engines were practically standard Pacific type with exception of firebox, which was equipped with combustion chamber and which required some changes in the original firebox design.

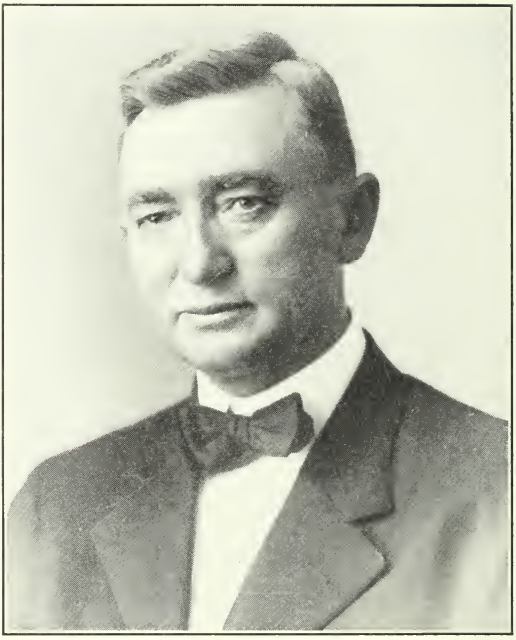
Five of the engines were placed on the Savannah Division, which is a division running from Savannah to Macon, a distance of 191 miles.

Lubrication

This being our first experience with this type of engine and having heard so much in regard to the trouble that others were having in lubricating the valves and cylinders, we were a little liberal with valve oil and gave the engineers sixteen pints of oil suitable for the superheater, for the round trip of 382 miles, and instructed them to use both valve and cylinder oilers. This method of oiling was kept up for a while. However, a test was made and after this test the cylinder oilers were cut out entirely and the oil reduced to eight pints for the round trip of 382 miles, or 48 miles to the pint of oil, and all lubrication of the cylinders and valves is through the valve chamber proper. The oil enters the main steam pipe about six inches above the steam chest.

We have never had any trouble in lubricating these engines, and so far it has never been necessary to renew either of the valve bushings or re-bore the cylinders, and the cylinder and valve chambers are in excellent condition. The mileage of these engines, up to date, is something over 50,000 miles each.

When we allowed the engines a large amount of valve oil, we found on going into the cylinder and valve chambers that a great deal of carbon had formed and the valve packing rings were stuck fast, and we were experiencing some trouble with cylinder packing rings breaking and sticking. After cleaning out and getting rid of this carbon formation and cutting the valve oil down to eight pints, we have experienced very little trouble from this carbon accumulation or from the rings sticking and breaking, which proves conclusively that the excessive amount of oil being used was simply burning in the cylinders and not doing the engines any good. For the past six months we have had no more trouble with the cylinders or valves than we have had with our saturated steam engines during very heavy work.



T. F. Griffin, First Vice-President

Method of Drifting

The question of drifting is one of vital importance to a locomotive using superheated steam, as undoubtedly nine-tenths of the carbon formation, worn out packing rings and cut cylinders occurs after the throttle is closed and the engines are allowed to drift into stations and down grade. Our Road Foreman, Mr. W. H. Prendergast, got up an ingenious little device whereby the throttle valve remains alightly unseated, allowing a small amount of steam to pass through the pipes into the cylinders. This little arrangement is controlled by the engineer in the same movement that he closes the throttle, as the device is part of the throttle ratchet rigging.

Flues

After these engines were put in service the middle of May, they gave no flue trouble until December. In this month some of the large flues commenced to give us some trouble. However, we stopped each one of the engines and gave these tubes a general good working over the water out of the boilers, using the roller slightly, but the prosser and beading tools were used about as much as they would have been in applying new flues. We experienced no more trouble to amount to anything until the latter part of May, this year, or until the engines had completed the 50,000 miles.

Just having installed at Macon an electric welding plant, the engines were put in the shop and the large flues welded in with this process. They have been running now about two months and so far have not leaked. The small flues have never given any trouble. I do not know just what additional mileage we will get out of this method as it is our first experience, but we hope that it will prove a success and we can continue to operate the engines until they will need a general overhauling.

We have never experienced any trouble on account of flues stopping up, either large or small, or dirty superheater units. The only accumulation is a small amount of soot, which is easily cleaned out with air. We attribute the flues not stopping up to the peculiar arch and combustion chamber, as the small particles of coal, large sparks and other things picked up by the exhaust and pulled into and through the flues, are kept in the firebox and consumed by the perpendicular arch, with which these engines are equipped.

We have in service several 21 x 32 inch consolidated engines (saturated steam) equipped with the combustion chamber, one of which a close record was kept for something over three years that flues were in boiler, flues making something over 100,000 miles. During this time flues were never cleaned and gave no trouble leaking. When removed (on account of age limit) they were in first class condition, and there is no telling how much longer they would have remained in service before giving trouble; while, with sister engines without this device, it is necessary to clean flues every few trips and only make an average of about 30,000 miles. I give this just to show a comparison of flue troubles between engines with and without the combustion chamber.

In May, 1912, one of the new superheat engines was placed on Macon Division in same service with the 21 x 28 inch Pacific type engines, and remained in service on this division for six months, inspection being made of flues after each trip by boiler inspector and Roundhouse Foreman, and frequently by our Master Mechanic, Mr. Fetner. During the six months' service there was not a particle of formation on return bends, or any accumulation in either large or small flues. Instead of being dirty they were bright, having appearance of being polished.

Superheater Units, Headers and Steam Pipes

We have had very little trouble and it has never been necessary to make any repairs to the headers or steam pipes on the six engines. During the period, however, that the engines made the 50000 miles, we had two ball joints to break off of the superheater units. Strange to say that this was two different engines, unit No. 1, and the same flue in each engine. Fortunately, neither one of these units caused an engine failure. As on the first occasion the unit was discovered broken in taking the engine out of the Roundhouse to the passenger station, and on the other occasion the unit was broken while the engine and train was being turned on the "Y" at Savannah after having just arrived.

In both cases it was due to defective joints, they not being properly secured to units.

Machinery

The general condition of the above on the six engines, after completing the 50,000 miles, was very good, in fact we had no more wear of the different parts than would have occurred on an engine using saturated steam. However, we placed one of the engines in Macon Shop June 10th for driving box, spring rigging, shoe and wedge work. The other five following will get about the same repairs. As this necessitated lifting the engines off of their wheels, we turned tires along with this work, although the tread wear was only $\frac{3}{16}$-in. We only spent at this shopping about $250.00 or not over $300.00.

I have some blue prints of this box, arch and combustion chamber, and will be glad for any members present, who so desire, to look them over.

I have some blue prints here, showing the little tubes on the throttle lever for drifting and one for the combustion chamber.

Mr. Logan: I want to confess that I did not hear one-fourth that Mr. Dickert said. And I do not think the rest did, and we do not want to wait till the proceedings are printed to learn what he said. I suggest that the paper be read again.

President Pickard: We would be very glad to grant the request if we had time.

Mr. Scott: We have on our division twenty-eight superheated engines and of course we are having our troubles from time to time that naturally occur from the fact that handling the power with any device that is counted economical for promoting the efficiency of the locomotives it takes time to become accustomed to it. I think it was in June, 1912, there was delivered to the D. L. & W. for the division that I worked on, fifteen superheater engines of the Mikado type, and up until probably from June until January or February of this year they went over the road without giving any trouble of any kind. We began to experience a little trouble with leaky superheater units and it became necessary to take the engines out of service and put the test on to discover the trouble, and it came to our observation that the slightest leak in the front end would put these engines out of commission — cut out their working conditions to such an extent that they would not give the power. It was necessary to take off the front end, strip out all the draft rigging, take out the unit pipes and make the necessary repairs; put back in again and give it the water test and put them in service. After we had done that on several engines they began to leak, and we had done good jobs on them with our tool grinding machines recommended by the superheater people. Then we tried the effect of putting our bolts in hot and allowed them to shrink together after the joint had been drawn, and we got good success from that method. I do not know of any trouble that we have been experiencing that would be of benefit to the members except that particular point. Maybe some of you who are handling superheater engines have tried it, but that is the way we have overcome our troubles with the superheater joints.

I do not find any criticism to offer in Mr. Lincke's method of handling any of the work, excepting that I do not believe in plugging up the pipes. I think that once you do that you are opening the way for a lot of trouble that will eventually put your engine out of commission and do a lot of damage. I would say it is bad practice. If you haven't a unit, hold the engine up till they come, and in that way you will over come that trouble.

In the line of tools for working up the heads, joints, etc., I would like to offer these drawings for the benefit of the members of this organization. Some of you may have improvements on the tools that we have here. We would like to compare them and have the members come up and look them over. They are tools designed for the joints header and gauges for the application of the units for the superheater locomotive. That is all I have to offer on that.

Mr. Miller: Do those blue prints come from the Superheater Company?

Answer: No, they are furnished by our Company.

President Pickard: All blue prints submitted to the Secretary must come to us in the tracing. Any of you who have blue prints to submit, must submit the tracing to the Secretary.

Mr. Hall: And the tracing must be black on white.

Mr. Masters: Have any of the members had any experience in welding the superheater tubes in the repair.

Mr. Miller: We plugged some but never welded any.

Mr. Smith: It seems to me that the most important thing in the maintenance of the superheater engines is to keep the friction down as much as possible. The common practice of turning the piston valve rings $\frac{1}{8}$ of an inch larger than the bore of chamber and springing them into place, I do not think is the proper thing. The practice that is followed by the American Locomotive Company and some of the railroads is to turn the valve rings $\frac{5}{32}$ larger than the bore of the chamber, cut $\frac{7}{16}$ inch out of the ring, close in a mandrel with a $\frac{1}{16}$ inch liner and turn to the exact bore of the chamber. That gives you a piston valve that has the friction reduced to a great extent, and a great many of the troubles from cut rings are done away with.

Another practice that I think is bad, is to put in piston valve bushings and not bore them out again after they are applied, especially the one in two parts. A solid bushing that goes clear through the chamber, perhaps that is all right, but when they are in two parts they should be bored out.

Another point that should be given special attention with the superheater is the lining of the valve with the chamber. It is an easy matter to keep the valve lined up with the new self centering valve guide that has been applied to a great number of recent engines; but with the other arrangement where a crosshead and guide is used, great care has to be exercised in keeping the guide in line. It should be lined with a line through the chamber.

The matter of oil pipes is also an important one to consider with superheaters. They should have a gradual drop from the lubricator to the steam chest and any sags or oil pockets will seriously affect the lubrication of the engine.

With a superheater an oil pipe breakage amounts to a failure. Hence care should be exercised to prevent the breakage, due to hard and brittle copper pipes. This can be overcome to some extent by annealing copper pipes when engines are undergoing repairs.

Most of the early superheater engines were equipped with a cylinder feed, but it is conceded at the present time that the cylinder feed is unnecessary and the oil is applied at the cylinder saddle in most cases.

The old system of having a split pipe that delivers the oil over the top of the valve is very poor. A great deal of the oil goes out in the exhaust and the pressure is reduced in the chamber and it is not sufficient lubrication. I have had experience in changing the engines over to the other system of oiling and it is more economical. Some simple form of atomizer gives good results. It goes in about the middle of the steam pipe and a small hole about 3-64 of an inch, or something of that sort, with sort of a nozzle attachment is very simple and gives much better lubrication. The object is to spread out the oil as much as possible to lubricate the steam before it goes to the valve. With the old method of a separate pipe it is almost impossible.

The superheater damper is another thing we have to consider in the maintenance. Lost motion is a very detrimental feature with the damper, because with lost motion we do not get the full opening of the damper and it results in inefficiency of the engine. The practice of the superheater Company is to use a drop forged piston without rings that is turned 1-1000 of an inch less than the bore of the superheater cylinder, and I suppose you gentlemen follow the custom that as soon as the piston has become worn, to groove the piston and apply rings. In my experience with dampers I find machinists would remove the damper and afterwards find that there was nothing wrong with it, and on examination find that the small steam pipe that led from the cylinder up to the damper was stopped up with corrosion with a carbonization from superheated oil, and several times after that happened we made it a practice to test the steam pipe before we removed any damper in the engine. It resulted in a considerable saving of time.

Another feature in connection with the operation of superheaters that I think we should consider is the pyrometer. On the New York Central they have applied pyrometers to engines in high speed service and they find it is a splendid means of checking the performance of the superheater engines. They

know when there is any drop in the superheat and it is the key note of the whole superheater question. Engineers are required to fill out a blank and give the highest and lowest rating of the pyrometer during a trip and thus they have a check on the engines.

In connection with converting superheater engines the question of injectors should be considered. They use the same injectors on the engines and find they are of too large capacity; the result is that the engines are not operated to the highest efficiency because the boilers are flooded. I have heard engineers say that with engines that have been converted, they could not feed the boiler continuously, and we all know that continuous boiler feeding is the only system to maintain economy in the use of fuel. I have noticed that there has been considerable trouble with cracked cylinders, especially with the old design of cylinder with the inside steam pipe. The outside steam pipe is much better. I have never seen a cylinder crack with the outside steam pipe. Probably the best way to repair a cracked cylinder is to patch the cylinder with steel; applied in the same manner that a boiler patch is applied. I have seen that work successfully; $\frac{3}{8}$ inch steel is used.

Superheater tubes can be cut out of the front end in a very successful manner by the use of oxyacetylene. On the New York Central they have an inverted burner that is turned around on the inside.

Another thing that we have got to consider in the repairing of superheaters is shop kinks. I have seen several that are worthy of mention. The top header of the Schmidt superheater is a very difficult part to apply, and in shops where overhead cranes are used an arrangement for lifting the header in place is of great value. It consists of a "T" arrangement which bolts to the header and a long bar. The crane is hooked to a chain and a man can handle the header by taking hold of the end of the bar and balancing the header.

I have noticed in some shops that the superheater elements are piled around on the floor in a mass and the joints are not protected while the engines are undergoing repairs. In the West Albany shops of the New York Central they have a rack for holding the superheater elements. It is nothing more nor less than angle plates with long rods passed through in order to hold up the superheater tubes. They use wooden placks to protect the joints.

Mr. North: I would like to ask the man from Chicago if he is not piling up trouble for the man who is going to take the bolts out of there. Don't you think there is more chance for corrosion?

Mr. Scott: It tightens and after it shrinks — we have not had occasion to take any of them out since we adopted that plan.

Mr. North: I think that is something that should be given consideration. It could be overcome. I would also like to ask Mr. Smith why he uses a $\frac{1}{16}$ inch liner.

Mr. Smith: In the superheater engines there is a great deal of expansion and you have to allow considerable.

Mr. North: We always fit them up joint by joint and had no failure.

Mr. Ashmore: We have sixty superheater engines of the Pacific type. I do not think we ought to go on record as Mr. Lincke says here in regard to the amount of oil used. I do not think that 25 per cent more oil should be used on the superheater engines than on the saturated. We use a Babbitt insert in a grinding machine, that holds the emery a little better. I do not know whether any one else does or not. We do not have any trouble with the back end of the tube breaking.

There was one question that Mr. Dickert spoke of — I do not quite understand as to what he thinks is responsible for the tubes not setting up. I believe he said they were in service for several months without needing any cleaning. We use a rod for cleaning.

Mr. Burleigh: The Rock Island has quite a few superheaters but I have not been in touch with them. On the division I am on they are still using the saturated engines.

Mr. Reyer: My information is limited. We have a few superheated engines, and we did experience some trouble with the return bend having a sand hole in it. We have had some trouble with the valve packing rings,

but I think the engines were something new to the men. About heating the bolts I would like to state that we have some of the plain superheated engines in the front end and we had trouble with keeping them tight. I heated those bolts with a blow pipe and we could remove them very nicely without any trouble.

Mr. Scott: I would like to call attention to one condition we run across on the passenger engine superheater and that is the carbonization of the valve on the superheater. They destroy them entirely by taking a hammer and chisel and driving that stuff out. I would like to ask if any present have experienced anything of that kind. This engine was equipped with a graphite lubricator.

Mr. Whiteford: We have superheaters running over the division where I am located but they do not stop off there at the present time. We have had a couple of engines that caused a failure and we had to take them in on account of the superheater unit leaking. We took them out and ground them in with lead, a preparation made on purpose to grind these joints and we had no trouble in putting them back, and no trouble with leaking whatever. That is the only experience we have had with the superheaters.

Mr. Butler: We have had quite a number of the Big Four, but the subject has been pretty well covered here. We did have trouble with leaky valves; the oil carbonized.

Voice: We inspect the valves every thirty days.

Mr. Ensign (N. W.): We have not experienced any trouble with the carbonization of the valves or cylinders. We also operated one for about six months with a graphite lubricator on each side. It gave us no trouble with carbonization. We had three engines with superheater joints that gave us trouble leaking. We did not have any apparatus for grinding and we put in $\frac{1}{32}$ copper gaskets. They have been in service six or seven months and we did not have much trouble with the flues stopping up. So we make it a practice to clean out these large flues every time the boiler is washed. When we first put the engines in service we were not fixed to and that carbon formed on the superheater unit in the flues and some of them started falling down on us, and we made it our business to clean the flues and we have been getting good results.

I would like to ask if any have had trouble with the piston packing of these engines. That is the principal trouble we are having now. We are using the King Tube packing.

Mr. Smith: I have seen them use alloy 60 per cent copper and 40 per cent brass, or 40 per cent copper and 60 per cent brass. I have heard of brass being tried, but it is a poor metal, it warps. Copper alloy is the thing that has been most successful.

Mr. North: We are using the King Tube packing and have no trouble.

Mr. Freeman: I would like to inquire if they have had any trouble with the stopping up of the superheater tubes in firing up without oil.

Mr. Gibson: In regard to firing with oil it might be a question of what kind of coal you are using after firing up with oil. At the time I left the New York Central we fired up with oil entirely and never had any trouble. Out of four engines there was one engine that the valve was carbonized and we had great trouble getting the valve out; that was due to drifting.

President Pickard: On the Lackawanna railroad we have some troubles that I presume you gentlemen do not run into in every day life. We burn nine grades of anthracite coal and one grade which is bituminous, with our superheater locomotives. We of course run into a great many problems. One of the things that has developed on the anthracite engines with the eating away of the unit tubes, the small feet form a bracket at the return end on the firebox, invariably on the anthracite engines; when they come in for general overhauling will work their way through and that of course has its effect upon the steaming of the engine. We have engines that haul passenger trains 58 miles per hour from Buffalo to New York. I have been placed on a division where they work at an 18 inch cut-off for two hours and fifteen minutes, and the superheater is working from about 620 to 680, the difference being in the engines, with which you are familiar. The piston rods on those engines,

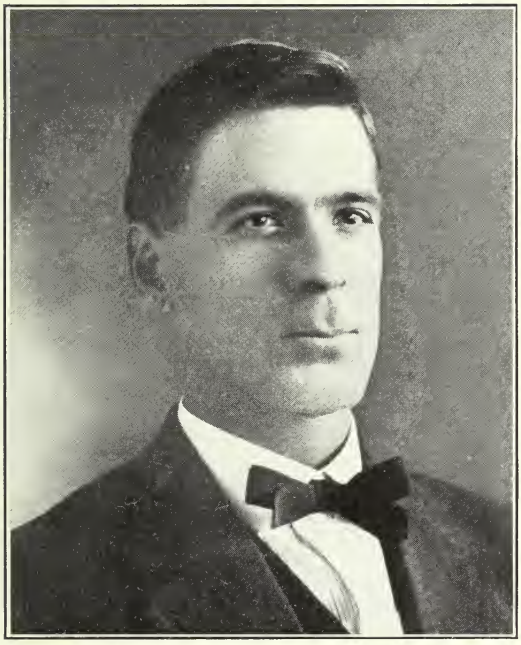
are practically blue when they get to the top of these hills, and any lubrication that is left on there is smoking, so that the piston rod friction and the packing is an important matter with us. We put it up to the metal companies who have furnished us a packing that seems to fill the bill and they designate it as K1. The engines burning anthracite coal the fire box area in grate surface is increased from 30 to 40 per cent over the locomotive burning bituminous coal and in order to burn that coal we have to have a high vacuum. These engines that have cylinders 25 to 28 long, the matter of lubrication on these engines is another problem from the fact that those engines are on the business ends of the quadron all the way from $1\frac{3}{4}$ to 2 hours. We went into it very thoroughly and conducted a great number of tests and went into the matter of graphite lubrication, which was brought out by one of our engineers. The problem was to get the graphite to the cylinders and valves as it was used. The trouble before with graphite has been that the lubrication was of a flush that was all at once. That produced results that were not desirable from the fact that it carbonized immediately and crowded up and it would work in behind the rings and cause valve motion from the excessive strain that was thrown upon it.

Mr. Scott who is off of the Lackawanna speaks of this, but my conclusion, after the investigation was all full was that Mr. Engineer who had that engine that he refers to put five sticks of one inch graphite on that engine and had the lubricator set so as to eat it all up. If we could keep the engineers using the graphite as the cylinder will take it, we could get results. We have a class of engines that have cylinders 22 x 30 that haul trains 740 tons on a 2 per cent grade. Those engines — after you get them up to 75 miles an hour — it was not safe to touch the reverse lever. After we put on the graphite lubricators, with what little experience I got, I could handle one of them running 65 to 75 miles an hour on any kind of throttle condition. I know from inquiry among the other railroads that a great number of them have cut out the damper.

When they drift so many miles the fire boys will take advantage of that time and work the blower — naturally have the blower on and there is a lot of heat going over and passing through the unit. If the damper wasn't there — that I believe is injurious. When they have no current I believe in maintaining a damper.

It seems to me from my observation that the problem of superheater will be solved by the proper care at the engine house.

When we first put these Mikado engines in service — they are 25 x 32 — pretty good sized locomotives — they operated 180 pounds steam pressure, and with bituminous coal we are running them $6\frac{1}{4}$ open nozzel. We had some steam failures, of course. With a class of engines thrown on a division like that with men who had been firing anthracite coal, they were strangled, and we had to conduct a campaign for educating the firemen. We went to the 6-inch nozzle, and immediately we got into a lot of trouble with leaky units. During this time there were three of these engines that had regular firemen and regular engineers. Those engines went up and down the division as slick as you please, so I got to thinking as to what the cause was, and I came to the conclusion that there was an excessive strain upon those units as well as a little flue trouble that we ran into from the small nozzle. I called in my two road firemen of engines and traveling fireman and put it right up to them. In the meantime I put instructions up to the various points to open the engine up to $6\frac{1}{4}$. Since that time our trouble from leaky units practically disappeared. We had some arbitrary cases of two particular engines. I called a conference of the general foreman and roundhouse foremen, and we talked it over and came to the conclusion that in putting these back in after they had been out, that the bolts were cold and when the engine went to working she pulled it up to a certain degree of heat which we had to estimate. We took the bolts and we heated them to what you might say a black heat so that a little water poured on them would sizzle. We tried to arrive at the heat that these bolts were under when the engine was working. Those two particular engines have given good service. They make 4850 miles per month on a 106 mile division, handling 3200 ton, and there hasn't been a steam failure or a whimper from the fellow running the engines.



L. A. North, Second Vice-President

At one other period during that time my attention was called in the engine house to the chain block across the smoke box, three or four men pulling out a unit, and I noticed in my daily rounds that the same men were in the same place the following morning and had only gotten out four or five units. Immediately I went into it as to what was the reason. The investigation developed that they were not being properly cleaned. At that time we had no man assigned to the cleaning of superheater units, so after our weekly conference we started out in the engine house, and we knew that the tubes were 21 feet, 6 inches. We measured up and found $\frac{3}{8}$ pipes were being used and they were about 14 feet 6 inches long. What they would take out of the rear end they would put up in the front end and leave it up there so we probably had nothing in service only a straight saturated engine with a limited flue area. This stuff would get up in the front end, would corrode and close them up, and you cannot get the units out. In addition to this the small points that are supposed to hold from vibration would twist around when they came up against this corrosion extend themselves against the wall of the tube and it would mean further trouble in getting them out. We went right into this in a strenuous way. Whenever we start to conduct an investigation we do not stop until we have reasonably placed the responsibility upon the man who is responsible for it, and we eliminate the condition, if it is possible to do so with our ability. So after we went through it and had a good understanding with all our engine house men, our boiler inspectors that are maintained at the various points, our trouble from leaking units has practically been eliminated.

It is up to you fellows.

Mr. North: One point in regard to the lubrication of the piston valve. We think that by grooving the bull ring and filling it with graphite, it adds to the life of the valve.

Mr. Masters: The reason I brought up the question of acetylene welding of tubes was this: We recently installed an oxyacetylene system generating our own gas, and in order to make dead sure any of the joints, we oxyacetylene all the joints after screwing together. We found after we did that that we had a lot of little holes similar to sand holes, and after we got our gas in the pipes we found we had leaks that we should not have had so we had a taken the pains to have a good tight fit. Therefore we had to go from time to time over the piping and patch up all those places, and in the course of two or three weeks we eventually got a good tight job, which could have been obtained very nicely with good threads and a good pipe.

I have had seven years' experience on the American locomotive, and we find that by taking pains with the joints, having a good thread and screwing them up properly, we make the thing final.

I personally do not think there is anything in the welding of the tubes in the return bend.

President Pickard: We have with us this morning a representative of the Superheater Company, Mr. Osterman, and we would like to hear from him.

ADDRESS OF MR. OSTERMANN.

Mr. President and Gentlemen of the Convention:

I appreciate the opportunity of saying a few words to you this morning, although in view of this complete paper, I have very little to add.

I might speak of the practice that Mr. Scott divulged, about the heating of the bolts that hold the units. The tendency is obvious and checks with our ideas. We think that the leaks of the unit joints are caused by the fact that the bolts when cold can often not be tightened sufficiently.

If you will think of the design of this joint for a moment. There are a number of surfaces that have to be brought into intimate contact, such as the ground ball on the header seat, the underside of the bolt on the washer, the latter on the clamp, the clamp on another washer and the latter on the nut. Experience has shown that even with great care in the application of the units and with a fair degree of workmanship, the first load runs sometimes produce a looseness of the joints, which can only be attributed to a readjustment of the various parts of the joint, due to vibration and expansion by heat. This looseness has to be taken up. As far as our knowledge is concerned,

most Railroads have obtained splendid success with the retightening of the units after the first load run. Personally, I think that the practice of heating the bolts is somewhat dangerous, because you cannot tell how much they are heated and how much they will shrink, which might result in overstretching.

Somebody spoke of the difficulty in keeping the damper operative and suggested the use of piston rings wherever trouble was found. I believe that with the new vertical design of damper cylinders that the Company is putting on the market now this difficulty is being avoided to a large extent. The weight of the piston does not cause any more wear in the cylinder, and we have every reason to believe that we will be able, with this design, to get along without piston rings. The objection is that these small rings gum up with oil very quickly, and afterwards the operation of the damper becomes less positive than without the rings.

I fully agree with the gentleman who spoke of the necessity to keep the units of an engine in proper shape, and who, if I remember correctly, condemned the practice of using dummy couplings. His remarks call for some comment upon the proper consideration of the superheater spare part stock. Unfortunately, it is impossible to always obtain an interchangeability of superheater header and units for various engine classes of one Railroad, without sacrificing from the start a portion of the effectiveness of the superheater. As railroads want us to design superheaters that help them to save a maximum of fuel and water, we are forced to differentiate in the header and unit dimensions, depending upon varying lengths over tube sheets, boiler diameters, contours of fireboxes, etc. For this reason, there are in use such a very large number of varying sizes of superheaters that it is a matter of financial impossibility for our Company to carry a stock that we could ship from on short notice and satisfy everybody. Therefore, it is up to the Railroads to supply themselves with spare parts for their various classes of engines, and to keep them in readiness for shipping them out to the various division points whenever the necessity for it arises. The General Foreman is vitally interested in the replenishing of the superheater stock, in order to keep his engines on the road without tie-up. Make some sort of arrangement whereby you can lay your hand onto a fresh unit any day, as one of your engines may come in with one that leaks. If some stock is on hand, you can pull the defective unit out and replace it with one from stock in a few hours, whereas the engine will be tied up for weeks if the Storekeeper has to place a requisition with the Purchasing Department. At the same time, make preparations at your Central Shop for repairing the defective units sent in from outlying points, and after repair, turn them back into stock to be further kept as spares.

I might say another word about the piston rod packing trouble that was mentioned. Our Company has been recommending a mixture of 80 per cent lead and 20 per cent antimony, and this mixture, regardless of the design of the packing, has been standing up on simple engines under ordinary service conditions. Isolated cases have been found where engines have been handled on long heavy grades, where the mixture did not have a high enough melting point. It must be understood, in this connection, that the temperature to which the piston rods are exposed increases with the power developed.

In such cases, copper has been used with good success and, as one of the members mentioned, they are having such a mixture on the market now.

A very interesting thing was brought out by Mr. Pickard about the wearing of the return bend lugs in the superheater flue. Was your experience on passenger engines?

Mr. Pickard: We only have anthracite coal burning engines with high speed attachments.

Mr. Ostermann: I had an opportunity to investigate a similar trouble the other day on a western road burning semi-bituminous coal on a high speed engine, and I am inclined to conclude that this trouble is due to the rubbing of the lug upon the flue, and that such rubbing will be found wherever the vibratory deflection of the unit becomes excessive. If you let your supports deteriorate, the unit will be held on one side by the header connection, while it is supported on the lug at the firebox end. Under these conditions, the unit pipes that are not rigid, but have considerable spring, will vibrate, due to the

impulses given them by the motion of the engine and the working of the spring rigging, causing the lugs to slide and rub on the flue.

President Pickard: Pardon me. The same class of engines that burn bituminous coal, running in service that is scheduled the same miles per hour, do not show the condition that we experience in the anthracite service.

Mr. Ostermann: In addition to the rubbing, there seems to be some substance which favors the wear of the return bend on the flue, which, in the case of that road, without doubt, is a very sharp cinder. The coal that you are using shows similar characteristics. On oil burners, the same thing was found, possibly due to the sand.

To avoid such trouble, you should keep your supports in good shape and in the right location. I do not believe that an occasional inspection of supports means a great deal of work or delay. Open the front end and let a man go in with a light, have another man in the firebox, and you can very well see whether the supports are in the right place, and this does not require the taking out of the units. Our Company has recently designed a somewhat wider and heavier support for such critical conditions.

I just want to say a few words about the practice of putting copper gaskets between the ball and the seat of the header, as was mentioned by the gentleman of the Chicago Great Western. Such practice will not give good results. The joint is a metal to metal joint, and should be maintained as such. If the copper gaskets begin to leak, the engine will fall down on the road very quickly.

Question: What do you consider the right practice concerning superheater dampers?

Mr. Ostermann: The Locomotive Superheater Company recommends the using of a damper. I do not believe, and I think you will agree with me, that the maintenance of the damper, from a shop point of view, is a very serious proposition.

The discussion about the advantages or disadvantages of the use of the damper, however, might be pertinent from an operating point of view. The damper of the superheater engine is recommended for the reason that whenever the engine is standing and no steam is circulating through the units, and when, at the same time, the blower is put on sufficient to give a strong fanning to the fire, we do not want the hot combustion gases to go through the superheater flues, as there is no steam passing through the units under those conditions, there is nothing that will absorb the heat, and the passing of the hot gases through the superheater flue would result in the overheating of the metal at the back part of the unit, possibly four to five feet. The life of the unit would thus be shortened, the threads will be weakened and are liable to pull out, as has been demonstrated in practice. European roads have had experience with this question, and they have all gone back to the dampers.

As far as the abolition of the air relief valve is concerned, I personally believe that if it will result in forcing the engineers to drift with a open throttle, it should be good practice. I know of some roads that have had good results with lubrication without air relief valves, but as to the full success, I am not prepared to say.

Mr. Cuyler: There may be a number of the foremen in the room who are not thoroughly familiar with the superheater locomotive. I have only had a very little experience with them. I received twelve about five months ago, and up to date we have had very little trouble handling them. But, for the benefit of the men here who do not know the principle of the superheater locomotive, I would like to ask a question. In the first paragraph of Mr. Lincke's paper, where he says it is claimed to effect a saving of 25 per cent in coal, 35 per cent in water and increase the horse power or hauling capacity about 33 per cent, and the cost of maintenance is only a little greater than saturated steam engines, I want to ask how they arrive at the 33 per cent.

Mr. Ostermann: This result is arrived at on the basis of the following conclusions: If, by the application of a superheater, an engine can be made to burn 25 per cent less fuel, we may also force that same engine, with the superheater, by lengthening the cut-off, at which we work it, to such an extent that it will use up the same amount of fuel that the saturated engine used. Assuming now that we get the same amount of work out of every pound of

fuel that we realized when the engine used 25 per cent fuel less, we can easily compute, that the engine is good for $33\frac{1}{3}$ per cent more power. The exact deduction requires a little calculation, which I will be glad to go through with you when you step up to our booth.

Voice: Explain the principle upon which the superheater is made.

Mr. Ostermann: A superheater is nothing more than a boiler appliance. It increases the capacity of the boiler, as the engine demands are decreased by it. The nature of the improvement that the superheater produces on the power of a locomotive as a whole is similar to that produced by the larger grate area or larger evaporating surface. The superheater, as you know, raises the temperature of the steam after it leaves the boiler and before it passes to the cylinders, taking the moisture out of it, and the heat imparted to the steam makes it more gas-like than saturated steam. The decrease in the demand upon the boiler is due to an elimination of cylinder condensation. After saturated steam is admitted to one end of the cylinder at say 384° F., it expands, changing its heat into work. The piston on the back stroke pushes the expanded steam, that has a very much lower temperature than before the expansion, past the same metal parts that were an instant before in contact with the steam of 384° F., into the exhaust. This fact, viz: that every part of the cylinder surface is alternately in contact with hot admission and relatively cool exhaust steam, causes what is called cylinder condensation. It causes part of the heat of the admitted steam to be abstracted from it for the purpose of temporarily heating up the cylinder metal, as it also causes the steam to be heated by the higher heat of the metal during the exhaust stroke.

This rapidly fluctuating exchange of heat between steam and cylinders, while it also exists in the superheater engine, is less fatal to the superheated steam than it is to the saturated steam. Saturated steam immediately condenses and assumes the form of water, loses all property of doing work, when it has to give up heat. Superheated steam only loses some of its superheat, but remains steam. Therefore, the big gain when you eliminate cylinder condensation by superheating.

The second reason why the superheated engine requires less pounds of steam is that superheated steam occupies a larger space than saturated steam. To fill a cylinder of a certain size with superheated steam requires the evaporation of less pounds of water than to fill the same cylinder with saturated steam of the same pressure.

It is most important, however, to mention that superheated steam does not raise the pressure in the steam chest. This can never exceed the pressure of the boiler. All you need consider, if you compare the operation of the superheated engine with the saturated one, is that the excess of work obtained by the superheat is due to a lengthened cut-off. We are, on account of the increased boiler capacity, able to run the superheated engine at the same speed that we run the saturated engine, with a longer cut-off, without going back on steam and water.

President Pickard: We thank you very much.

While the superheated locomotive is new to the mechanical world in this country, it is not new in the old country. People have been watching that closely for a great number of years and seen it in all stages. We have a gentleman with us this morning, who has been in the Railroad Mechanical field and followed it up closely since 1859, probably rode on a superheater engine before we dreamed of one, and seen it in all its stages, and there is no question but that Dr. Sinclair of the Railway Locomotive Engineering can give us some valuable information.

Dr. Sinclair: I think it would be a little tedious to follow the experience that I have had with the superheaters, but I think that I can make the principle that the superheater acts on plain to you. A great many years ago, we began to hear much about cylinder condensation, and one of the most celebrated experimenters of the locomotive found out early in the game that a great proportion of the heat that went into the boiler was wasted in the cylinders through condensation. There are several influences in the cylinder that tend to convert the steam into water. Saturated steam, when it comes from the boiler, is always on the boil point, and the grooved cylinder had the

effect of condensing the steam when it entered, and left it evaporated at the end of the stroke. That effect was very plainly demonstrated as early as 1854, and the railway companies repeatedly tried to avoid that source of expense but the locomotive was a very difficult engine to put the necessary appliances to. A good many years ago, I was with a marine engineer, and at that time there still was a difference of opinion among engineers as to what the superheat would amount to. On the certain port that I was on, the second engineer, who is always the executive man in the engine room, did not believe in superheat, and we had the superheater on a number and he had it cut off all the time. He said it brought unnecessary complication without any gain in steam. The chief engineer, who was one of these men ready to give in to the stronger opinion, gave in for a time, but afterwards, I must say that I talked with him on the subject and he said that he would try the superheater and make some very careful tests with coal, so that way they put the heater in use for a watch, four hours; then they used the engine without the superheater four hours. They did that about a half a dozen times or so, and it demonstrated very plainly that there was about 20 per cent saving with the use of the superheater. The effect of superheated steam is that it has more heat in it than saturated steam, and if it goes into the cylinder where the saturated steam is, it keeps that condensed. As soon as steam drops back into water, it is useless; it has no power and its effect is to rob the steam of part of its energy, and that is what happens with the locomotive superheater. The saturated steam is given new life, and its energy is revived as it were, and that is where the saving comes. There is no question about the saving. The difficulty has always been the mechanism. I think that the superheater is the most promising part on a locomotive today, and the greatest improvement that there has been put upon it.

President Pickard: I want to ask Mr. Ostermann a question. Has your Company ever considered the reducing of your connection to the header from the unit? What has been your observations in the way of corrosion on the interior of the unit pipes? Have you ever considered the design of the operating lever to the damper rod—the method of the application to the end of the rod in securing it? Has it ever come to your notice that an engine that was foaming introduced certain elements into the header that has a bad effect upon it? What have been your observations in relation of the throttle to the cut-off, and what are the recommended practices, from your observation as to the cut off and the throttle of the engine?

Mr. Ostermann: Regarding the design of the connection between the unit and the header, I beg to say that this ball joint that we are putting out now is the second design. We started out with the gasket joint, which did not give very good satisfaction on account of the fact that you could not obtain a gasket which would stand the effects of the superheated steam. Copper and brass gaskets have been tried, but their life was rather limited, and we designed a metal to metal joint. From the success that we are having with this present ball joint in keeping it from leaking, if the proper methods of retightening the bolts are used, I am inclined to believe that there is no reason for a change of a design. We have improved recently the method of forming the balls. We used to make them by welding a collar on the steel to tube and turning it off. Now we upset the tubes in a special die, which does away with the breaking off of the ball at the end of the pipe. I have not heard of recent failures and I think that solves the difficulty.

We have never heard of any corrosion in unit pipes, and I cannot see any reason why any such corrosion should be expected. Of course, there is corrosion on the outside of the pipe due to the fact that it is in contact with the gases.

President Pickard: Are your observations made from any particular district?

Mr. Ostermann: My personal observations only cover conditions west of Chicago. I do not understand Mr. Pickard's question with regard to the connection of the damper to the rod.

President Pickard: The rod that runs through the smokebox that the damper swings on is operated from a valve with a crank arm. A great number of engines that have come to my observation, that has been secured with

Walter Smith, Third Vice President

a set screw which was inadequate for the thrust thrown upon it and the design was not desirable, then the pin was the next stop. The rod was so small in diameter on the end that when you put the pin in it, there wasn't enough metal left to get the proper facing, and it would seem that the design needed some attention.

Mr. Ostermann: As far as I know we have not made any further modification of this detail. Did your last engines have the same thing?

President Pickard: Yes. So far, they are all right, but they have only been in service three weeks or more.

Mr. Ostermann: We never heard of any substance being introduced into the header or units due to foaming, except the dry pipe sleeves were found to leak.

As to the relation of the throttle to the cut-off, our instructions are that whenever possible the engine should be run with a full throttle, and the reverse lever and cut-off regulated to suit the load, for fuel economy. That "whenever possible" was given for the reason that it is impracticable sometimes to run engines with a full throttle, because they would not ride easily enough. It depends apparently upon the spring rigging and balancing, as to whether it is possible to run an engine so that the engineer can ride in comfort with a full throttle. A lot of engineers prefer to give the engine a little more cut-off and ease off the throttle.

Mr. Scott: In behalf of the members of this Association I wish to thank you.

The privilege of the floor is now granted to Mr. Manchester, who will tell us something of lubrication.

Mr. Manchester: I want to thank you for the privilege that you have extended to me. I have listened to some of your troubles, and as an oil man, I frequently come in contact with the same conditions that you have represented here on the floor. In order to talk lubrication it will be necessary for you and me to go into the manufacture of the different elements. It is necessary to do this in order to explain what we are attempting to arrive at in the lubrication of the steam cylinders under either the saturated or superheated conditions. After the crude oil is taken from the ground and goes through the refinery, it is manufactured into a number of different products. We get naphtha, gasoline, kerosene, paraffine, and a great many other products. These products come from the crude oil at different temperatures of distillation, and the product resulting is of a flashing point of the distillation temperature, so that when we come to different steam cylinder oils we have a flashing point between 520 and 540 degrees, depending upon the distillation or the heat that has been applied. If we wish to raise the flashing point of this cylinder oil and continue to raise to 725 or 750 degrees we find there is no oil left in the distillate and have only a refuse of gas coke or free carbon, which is part of the oil. In explanation, if we pass the temperature of 540 or 550 degrees there is a breaking down of the oil elements, hydrogen and carbon, with free carbon in form of gas coke liberated, so that we get a very thick oil, it is impregnated with gas coke and it is necessary to filter it twice, and after filtration, when you place a drop of this oil upon a white blotter we find particles of gas coke on the surface of the blotter after the oil has been absorbed, I would not consider gas coke a good lubricant. The oil distilled down to 590 degrees flash is called superheat oil, and the oil distilled to 540 flash is called perfection oil, so that we have the superheat condition two kinds of oil, both of which are and can be used successfully.

We have both these oils in service and they are giving good results, but in going from one point to another, I find there are a great many enemies of good engineering, or of good operation of engines. You go to one part of the country and they have splendid coal and splendid water and a splendid corps of workmen in the roundhouse, men who have been there for years. Other places they are handicapped under conditions of having men change daily, weekly or monthly, and it is a hardship to get good service. I have seen unit pipes coated with mud scale $\frac{1}{8}$ to $\frac{1}{4}$ of an inch. I have seen the superheat flues filled solid. I have also seen saturated steam engine flues in the same condi-

tion. Engines burning coal would plaster a clinker on a flue sheet in going half way over a division.

I believe your chairman mentioned this as one of the things he got into and corrected. It means close attention to get the results. I have found that our mechanical lubrication conditions have to be followed the same way. He mentioned that you ought to give a gradual slope to the oil pipe in order to get away from oil pockets. If you have an oil pocket in the pipe it is only a question of a short time before you have a cut valve or burned out rings. A free delivery of oil is necessary, more so with the superheated engine than the saturated. You cannot stop the oil flow to the cylinder for one minute while you are working the engine at its capacity, or anywhere near its capacity. There are a great many lubricators in service that do not give you that absolutely constant flow. At times the valve oil comes down in flushes on account of poor mechanical condition. If you would place a water glass on the steam chest when working under certain conditions, you will find that there are 15 to 30 minutes that you do not get any oil in the cylinder, and when you reduce the throttle pressure you will get the entire amount of oil in a flush.

I haven't my blue prints that I usually carry with me when giving these oil talks, as the pleasure of being called upon to address this meeting was unexpected, and in order to explain without blue prints what is taking place in the cylinder, I will have to make a word picture of what is taking place in the cylinder during the different periods of the valve operating.

The engineer uses sufficient amount of steam to hold the wheels to the rail, and a sufficient amount of cut-off to start his train, which is usually with his lever in the corner. After his engine is under way the throttle is graduated and the lever is brought back to the running position. This is usually the way he makes his time and pulls the train at its capacity. It will average 6 or 7 inches of cut-off, and in making this cut-off, the valve will release the steam at 20 to 22½ inches, and from cut-off to the release is the expansion period of the steam, and the piston finishes the 26 inches of stroke, returning then to the point of compression, with the valve making the connections with exhaust pipe from point of release to point of compression. We will shut off the engine and find from the 7th to 10th exhaust after shutting off the throttle that the air valve or the relief valve on the steam chest opens; the piston now becomes an air pump, and we have found that a 2½-inch air valve will not furnish enough air, so that when the cut-off comes on the valve, we have a partial vacuum in the cylinder at that point.

The next connection of the valve with the cylinder is the exhaust port, and what was expansion period of the steam is now a vacuum period. This vacuum is filled by the valve connecting the cylinder with the front end of locomotive, bringing into cylinder, cinders, ashes, and front end gases at their respective temperatures. I find that in taking the burned substance off of the piston head and valve head an analysis shows 85 to 90 per cent are cinders and ashes from the front end adhering to the oil covered surfaces and the oil naturally burning off. We have found occasions where this accumulation on the piston and cylinder heads was sufficient to knock out the cylinder head. And it is due to the dirt that is being brought into the cylinder through the shut-off and the throttle at a high cut-off of the reverse lever.

In the experimental apparatus used by the Galena-Signal Oil Co. at different conventions, it was shown that regardless of the flash of the oil that the perfection valve oil with 540 degree flash, or superheat oil with 590 degree flash would pass through this apparatus in superheated steam where the temperature was up to and above1000 degrees, without the oil being affected, but regardless of which oil we used where we bring the atomized oil and vapors into steam chest and cylinders, where a higher degree of superheat has been used, bringing air which will be heated up to this high temperature into cylinders through steam chest relief valve, then putting the front end temperature from 1400 to 1800 degrees, combined with cinders, also at that temperature we have all of the elements properly placed of an internal combustion engine, with our atomized oil as the fuel, the air for our mixture and our heat and cinders as the electric spark, and naturally the resulting explosions or burning of the oil.

You can switch with a superheat engine just the same as with the saturated, with the lever in the corner and throttle shut off, as the damage is only due to the shutting off of the throttle under high cut-off as with no expansion of the steam there will be no vacuum period with throttle closed. After the burning of the oil on the exhaust side of the valve, and the piston on the back stroke come to the point of compression, compressing the hot gases and the valve opening to the point of lead, this compressed gas is thrown into the steam chest resulting in the burning of oil on the steam side of valve as well as on exhaust side, burning and carbonizing the oil, and as I have seen, making it impossible to pull the valve. I saw one valve that was impossible to move, and as a result they broke the valve out.

I found both oils giving perfect service. This perfect service is only given where the operation of engine is perfect, that is, that the engine throttle must not be shut off while the engine is moving with the reversed lever in high cut-off.

Thanking you for the opportunity of addressing you, and hoping my explanations will help solve some of your problems.

President: We thank you for your discussion.

The following were appointed to act on a resolution committee: Messrs. Logan, Gale, Cuyler, Dickert, Reyer and Prye and Nannery.

ELECTION OF OFFICERS

Mr. Logan: I take great pleasure in placing in nomination for President of this Association, W. W. Scott.

Seconded by Mr. Smith.

The name of Mr. W. T. Gale was placed in nomination.

President Pickard: If there are no further nominations, we will proceed to ballot. The nominees are W. W. Scott and W. T. Gale.

The ballot resulted in favor of Mr. Scott and he was duly declared elected.

For first vice-president Mr. Reyer placed in nomination the name of T. F. Griffin.

It was moved by Mr. Smith that the nominations close and that Mr. Griffin be declared the unanimous choice of the convention.

Carried.

For second vice-president the name of L. A. North was placed in nomination by Mr. Scott, who moved that the nominations close and that the ballot of the convention be cast for Mr. North. Carried unanimously.

The name of Walter Smith was placed in nomination by Mr. Reyer for third vice-president, and it was moved by Mr. Scott that Mr. Smith's election be made unanimous. Carried.

The name of G. H. Logan was placed in nomination for fourth vice-president by Mr. Scott. And Mr. Logan nominated Mr. W. T. Gale.

The ballot resulted in favor of Mr. Gale and he was declared elected.

It was moved by Mr. Scott that the Secretary cast the ballot of the association for Mr. Gale. Carried.

And thereupon President Scott took the chair.

Mr. Smith: For Secretary and Treasurer of this Association I move you that Mr. Hall be unanimously elected for the ensuing year. Seconded by many and carried unanimously by a rising vote.

For members of the executive committee Messrs. G. H. Logan and C. M. Newman were elected.

President Scott: I want to take this occasion to thank you and to express to you my deep appreciation for electing me to the office of President of this Association, and trust that at the conclusion of my term you will have no occasion to regret it.

Mr. Gale: I would like to announce that to-morrow at 3 P. M. there will be a special train at the Northwestern depot at the disposal of the members and their friends to take them out to the Northwestern shops. We would like to have all the members at the depot before 3 if possible, so that there will be no delay in getting out there.

Mr. Pickard: Permit me to say a few words on that proposition. Last year the Illinois Central took us to their shops and our visit was very profitable to everybody that took the trip. We saw a lot of things that we were benefitted by. Mr. Quayle has been a staunch advocate of the General Foremen's Association and been right behind it year in and year out, and I would like to have each man a committee of one to ask some other man to go along. Make everybody go. They have a lot of good things out there to show us.

Mr. Reyer: Can we not take a rising vote to see how many will go?

President Scott: The chair would not accept a declination from any member here.

And thereupon the meeting adjourned.

THURSDAY MORNING SESSION

President Scott called the meeting to order at 9:30 A. M.

Apprenticeship

Mr. F. W. Thomas read the following report:

Topic No. 2—Report of Committee on Apprenticeship.

Mr. Chairman and Gentlemen of the International General Foremen's Association:

Your committee prepared a list of seventeen questions regarding the apprenticeship subject and sent them to forty-five representative concerns in the United States, asking for replies to the several questions. Twenty-five of these letters were addressed to Railroad Companies, and twenty to other corporations, such as engine builders, electrical manufacturers, etc., etc. The following is a condensed abstract of the information received in reply to the questions:—

Question No. 1. "Number apprentices employed?"
Railroads, 4925; other corporations, 3004.

Question No. 2. "Age Limit?"
Railroads, from 15 to 22 years; other corporations, from 16 to 21.

Question No. 3. "Educational qualifications of applicants?"
Common school education.

Question No. 4. "Number shops employing apprentices?"
Railroads, 168; other corporations, 38.

Question No. 5. "Are apprentices given any educational advantages?"
Yes.

Question No. 6. "Number apprentice school instructors?"
Railroads, 96; other corporations, 51.

Question No. 7. "Number apprentice shop instructors?"
Railroads, 61; other corporations, 48.

Question No. 8. "Hours apprentices attend school per week?"
Railroads, average 3.61 — vary from 1 to 6; other corporations, vary from 2½ to 8, average 5 hours.

Question No. 9. "Are apprentices paid while attending school?"
Railroads: Out of 18 replies, 16 pay while attending school; other corporations: 17 out of 20 pay regular rate while attending school.

Question No. 10. "Subjects taught in school?"
Railroads: Spelling, letter writing, Arithmetic, Elementary Mechanics, Materials, Drawing, Trigonometry, Physics; other corporations: Subjects vary according to needs of different corporations, much attention being given to character building, courtesy, civility, etc., the practical subjects relating directly to needs of each company.

Question No. 11. "Is instruction during daylight working hours?"
Railroads: Out of 18 replies, 16 give instructions during daylight working hours; other corporations: 17 out of 20 give instruction during daylight working hours.


Ninth Annual Convention Banquet
International Railway General Foremen's Association.
White City Casino July 16, 1913.
Chicago.

Question No. 12. "Length of apprenticeship?"
Railroads: 2 from 3 to 4 years; 3 from 4 to 5 years; 13, 4 years; other corporations: 12 require an apprenticeship of 4 years, the other 8 vary from 2 to 7 years.
Question No. 13. "Per cent of boys entering who complete apprenticeship?"
Railroads, 71%; other corporations, 65%.
Question No. 14. "Per cent of graduates remaining in the service?"
Railroads, 77%; other corporations, 56%.
Question No. 15. "Do you encourage your graduates to remain?"
Railroads, Yes; other corporations, Yes.
Question No. 16. "Is any bonus or prize offered boys to complete apprenticeship?"
Railroads, Yes, 3; No. 15; other corporations, Yes, 13; No. 7.
Question No. 17. "Have results obtained justified your trouble, expense, etc., of educating and training your apprentices?"
Railroads, yes; other corporations, Yes.

From the information received it is evident that the subject of apprenticeship is attracting considerable attention, and there has been a substantial development in the work. In addition to the larger and more prosperous railroads in the country, nearly all of the large industrial concerns have instituted educational courses, some of these have regular apprentice schools, others co-operate with the public schools in the continuation schools or part-time system and still others have made arrangements whereby the men whom they are training may receive instruction through the correspondence schools or Y. M. C. A. schools. These courses are offered to their employees not only by the large corporations making railway supplies but by the large Department Stores, etc.; even large banking concerns organizing schools to train men to handle their auxiliary organizations such as Gas and Electric Power Companies, Street Railways, etc. Many of the men trained by the large supply companies go out and work for the companies purchasing their supplies. In addition to teaching these men subjects relating directly to the needs of their respective organizations, they also teach character building, politeness, and the ability to "get along." Probably some 200 corporations are now offering their employees educational advantages paying them for the time spent in school. They would not be doing this if it did not pay them in dollars and cents.

The committee unhesitatingly recommend to the Association that the question of apprenticeship is worthy of consideration by the officers of railroads, and manufacturing concerns, and submit the following reasons:

First: Apprentices have proven satisfactory from a commercial standpoint.

Second: Graduate apprentices have been advanced to positions of authority in many shops. The apprenticeship system is harmonious in a shop employing either the day work or piece work system. Your committee recognizing the fact that there is a wide difference in organization and local conditions as to available material and facilities for instruction, considers that a hard-and-fast general apprenticeship code is impracticable, and, therefore, suggests the substitution of basic principles rather than a formal code.

Principles

To assure the success of the apprenticeship system, the following principles seem to be vital, whether the organization is large or small:—

First: To develop from the ranks in the shortest possible time, carefully selected young men for the purpose of supplying leading workmen for future needs, with the expectation that those capable of advancement will reveal their ability and take the places in the organization for which they are qualified.

Second: A competent person must be given the responsibility of the apprenticeship scheme. He must be given adequate authority, and he must have sufficient attention from the head of the department. He should conduct thorough shop training of the apprentices, and, in close connection therewith, should develop a scheme of mental training, having necessary

assistance in both. The mental training should be compulsory and conducted during working hours, at the expense of the Company.

Third: Apprentices should be accepted after careful examination by the apprentice instructor.

Fourth: There should be a probationary period before apprentices are finally accepted; this period to apply to the apprentice term if the candidate is accepted. The scheme should provide for those candidates for apprenticeship who may be better prepared as to education and experience than is expected of the usual candidate.

Fifth: Suitable records should be kept of the work and standing of apprentices.

Sixth: Certificates or diplomas should be awarded to those successfully completing the apprentice course. The entire scheme should be planned and administered to give these diplomas the highest possible value.

Seventh: Rewards in the form of additional education, both manual and mental, should be given apprentices of the highest standing.

Eighth: It is of the greatest importance that those in charge of apprentices should be most carefully selected. They have the responsibility of preparing the men on whom the roads are to rely in the future. They must be men possessing the necessary ability, coupled with appreciation of their responsibilities.

Ninth: Interest in the scheme must begin at the top, and it must be enthusiastically supported by the management.

Tenth: Apprenticeship should be considered as a recruiting system and greatest care should be taken to retain graduated apprentices in the service of the Company.

Eleventh: Organization should be such as graduated apprentices can afford to enter for their life-work.

In addition to the principles set forth above, your committee urges the necessity of having adequate instructions for the shop and not submerging this part of the boy's education with the school room work. While we recognize the great value of the school room instruction, we believe the one should supplement the other. The principal objection offered by Foremen to apprentices in the shops is the time which must be spent with beginners. With adequate shop instruction the Foreman is relieved of this. The boy is given assistance as soon as he enters the shop and is made productive at once. It has been demonstrated that where you you have twenty apprentices in one trade in a shop the increased output of the boys brought about by a practical Instructor, will amply justify the employment of a Shop Instructor.

F. W. Thomas, Chairman.
C. W. Cross,
E. V. Lea.

Supplementing the report as follows:

Your committee not being active members of the Association, has not felt like taking the liberty of preparing a binding report. We collected as much information as we could and have placed it in a concrete and greatly condensed form. Local conditions make different detail methods or different means. As an individual and one engaged in the apprentice work I wish to supplement the report.

While all of the railroads included in the report and also the manufacturing or commercial concerns, show a determined spirit to give the boys in their employ the best opportunity possible to learn his trade, it is a further evidence of a necessity which the times has demanded. The modern shop offers little chance for a boy without some one to guide and direct. The Foreman and the Gang Foreman are too busy, have too many other duties to perform to be bothered with green boys. A boy floundering around a big modern shop four years with no kindly hand to help or direct him, is what gave the old apprentice system the black eye, from 1890 to 1905. He was a failure, for at the end of four years he knew next to nothing of the trade. The old hand passed away in the natural course of years. There was no trained man to take his place. That is why you suffered such a dearth of first-class mechanics. That is what drove you to the specialist, the handyman, a man who could success-

fully run one machine but none other. The rapid growth of this country, the great increase of manufacturing plants, the increase in railroad shops, the great auto factories and garages, all demanding mechanics, a demand many times over the supply. You often point out some old man in your shop as being a fine first-class mechanic; he served his time years ago when serving was good. When the foreman had the time, the patience, the fatherly interest in the boy, he was given a good opportunity, he progressed and he loves the work. You point out others who are often called boomers. You speak of your pick-ups. You picked up a man off the street and put him on a bolt cutter and a bolt cutter he is today. You picked another from the slums and put him on a boring mill and a boring mill hand he is today, and no more. You picked another from the farm and put him driving rivets and a rivet driver he is today. You picked another from the wharf and put him running a forging machine and a machine forger he is today. What will the bolt cutter do when there are no bolts to cut? These leave you and go elsewhere, hiring out as machinists.

The Santa Fe Railway said to the General Foremen and Foremen: "We know you haven't the time to pay much attention to these boys; you look out for the output of the shop and your other duties, and we will put a man there whose sole duties will be to look out for the apprentices, responsible to you for the boy's progress and work. He will move them from machine to machine, from job to job, showing them step by step, and then we will have a school room, the boy will be taught by another Instructor such subjects as he needs in his trade, receiving the mental training along with the practical." With the present system we have found the boy with the assistance of his Shop Instructor becomes productive at once. No time is lost in experimenting, and finding his place, or getting over his stage fright. He is made productive at once. In the absence of a regular man on any machine, our Foreman simply says to the Shop Instructor, "Put one of your boys on that machine while Joe Smith is off." He does it, and stays with him enough to insure a reasonable day's output. The success we have attained with our apprentices has been due to the full, ample shop instruction. I believe with Mr. Basford, that the present shops need more Instructors and fewer Inspectors. We have an Assistant Vice-President on our road, one who was reared on the road, who is now in his forties, and every day of his life since he was fifteen, has been spent in her service. · Served his apprenticeship and was Gang Foreman before he was out of his teens, and was promoted through the entire line step by step. He had none of these present day advantages, was denied the advantage of an early education, but possessed with an abundance of unerring common sense, he is at one and the same time a leader, a driver, a worker, and a friend. Recognizing the advantages such an education gives a boy learning his trade, he established a night school for his apprentices, rented a room and employed an Instructor from his own pocket. This is the first railroad apprentice school of which I have any knowledge and it was fifteen years ago. It must be a source of some pleasure and gratification and recompense for his labor and expense that over half these boys are now occupying some official position on the railroad. As to the value of Shop Instructors, he wrote a Mechanical Superintendent in reference to putting on an additional Shop Instructor, saying: "A good Shop Instructor is worth $350.00 per month in any shop, and there should be one for every twenty-five boys.

We are not trying to make Mechanical Engineers; the colleges furnish these. We are not trying to make Draftsmen; the schools furnish these. We want to make first-class skilled mechanics to operate our machines, men who are trained and educated in our ways, our methods, our standards, whose home and family ties are within our midst. We are making them proud of their work, and their road, and the apprentice system which has made their present condition possible.

Mr. C. W. Cross reported as follows:

THE APPRENTICESHIP SYSTEM

Mr. President and Gentlemen of the International General Foremen's Association:

As a member of the committee I can only add to the report, a few remarks of a general nature.

The purpose of the apprentice system is to provide the Motive Power Department of railroads with an adequate recruiting system which will eventually produce from the ranks a large number of skilled workmen, a number of foremen, a sufficient number of good draftsmen, a few Master Mechanics and an occasional Superintendent of Motive Power.

The general plan is twofold, and provides for shop instruction of the apprentice in the trades and also for his instruction in mechanical drawing, practical mathematics and shop problems during working hours while under pay.

For the information of those who may wish to inaugurate a plan of this nature the following points will perhaps be useful:

First: The selection of a shop instructor already employed in some capacity at the shop in question, who is preferably an up-to-date all-around machinist competent to give direct instruction in the machinist trade, but with sufficient knowledge of the other trades, which may have local apprentices, to be able to intelligently supervise apprentices in those trades.

Second. The selection of drawing instructors, preferably draftsmen or mechanical engineers, who possess the rare qualities necessary to successfully instruct ungraded classes under new and trying conditions.

Third: To obtain and equip suitable class-rooms located near the center of the shop property.

Fourth: To secure the hearty co-operation of shop superintendents, foremen, gang bosses and mechanics who have been trained under a different system, and where co-operation is essential to make such an apprentice system a success.

Fifth: To obtain from the average apprentice a proper appreciation of the opportunities offered and an enthusiastic endeavor to make the most of them.

Sixth: To introduce the training system for apprentices in a manner that will not interfere with the operation of the shops.

It seems to me at the present time there is no more serious problem confronting the railroads and manufacturing concerns, especially the mechanical department, than the future relationship between the employees in the mechanical department and the companies. We find that probably as much of the time of motive power officers is taken up in considering the difficulties of the labor problem as is devoted to the strictly technical subjects of the department. The growing tendency to specialization seems to have led to a lack of general all-around mechanics in the shops, and it has been noticed in probably every shop in the country that there is a great dearth of suitable men, when a good man is desired for a foreman, and the man in charge of the shops of the department, looks about to find a man of the right caliber and a man who has enough of general information on his department work to be put in charge of men. That problem has to be faced and it seems to me that the step that has been taken by the several roads which have established apprentice schools on a comprehensive and broad scale is one of the most important moves that has been made by the railroads and manufacturing concerns in this country for a long time. The railroads interested in the apprenticeship training will be willing to give out on request the methods by which they are producing results where the system has been in operation. There is nothing more important for the future good of railroads, for raising the standard of mechanics in the shops, than the establishment of a thoroughly comprehensive and wisely carried out system for educating apprentices, so that we can have all-around mechanics and not men who simply know one little specialty and take no interest outside of that.

There has been a tendency lately, in connection with various organizations, to seemingly lower the standard of efficiency of the men. I believe that an apprenticeship system will offset that tendency and raise the standard permanently for the future, as it should be raised, so that instead of going through our shops and comparing the present class of man with those of fifteen or twenty years ago, and commenting as we do now that they are not up to

the old standard, that we may in a few years from now look through the shops and find the standard constantly improving, and so that others may look to the railroads as an example of the best methods of raising the caliber and the general standard of mechanics. There is a common tendency in shops for foremen to feel that they must, in taking young men into the shops as apprentices to become mechanics, to get all they can out of them—to get all the value possible at first from their services, forgetting that one of the desirable features in training apprentices is to make them first-class workmen. The value cannot always come in the first year of their apprenticeship, but just as surely as they are properly trained, the value will come to the company and to the community at large from their services after they have been properly trained, and I think we should not forget to make the proper training of the young men the first consideration, and the getting of the value of their services in the first year of their apprenticeship secondary. Surely the best results will come in the end by carrying out this principle.

The committee assembled these lantern slides, 68 in number, for the purpose of illustrating the subject of apprenticeship in connection with the report. Of course, these few pictures do not cover the subject completely, and they are only intended to be representative pictures from a few of the Manufacturing Concerns and Railroads which have established apprenticeship systems. Additional information may be obtained by those desiring to go into the subject more fully.

It is perfectly safe to accept the proposition that apprenticeship is to be a permanent factor as an American institution. We need skilled workmen who understand their work and its relation to the work of others, and who are prepared as citizens to take their places in the organization of human life. To supply the need we must train the hands and the minds of our recruits. The present emergency seems to compel us to take the school to the boy for the training of the mind. Our greatest work is in the shop. The boy is in the shop and we must move the school to him for we cannot move him to the school. We cannot wait for the educators to adapt themselves to our problem, but must take it in hand ourselves.

If the efforts of the committee will influence the members of this organization to take an interest in the subject of apprenticeship, and recommend to their superior officers the establishment of a broad-minded apprenticeship training, we will feel amply repaid for the effort.

Mr. Logan: I am under the impression from these slides and the number as I recall it, that at the Topeka shops there are 223 apprentices. Is there no limit?

Mr. Cross: At the Topeka shops, which is the headquarters of the Santa Fe, they have a large number of apprentices there, but not what you would say the largest per cent of apprentices. It is a large shop. At the Collingwood shops of the Lake Shore there are 111 apprentices. That shop is a combination of car and locomotive shop. On the Pennsylvania Railroad at Altoona there is something like 250. Of course the largest number is in the engine and blacksmith department, but they have apprentices in all trades. I would not say that they have an unwielding number.

Question: How do you base the number that you employ?

Answer: On the New York Central lines, on an arrangement with the different labor unions on a basis of 1 to 5.

Mr. W. Smith: The great problem that confronts motive power officials at the present time is not so much a matter of better shops and facilities or even of better methods, as it is with the men. Its solution is largely a matter of recruiting and raising the level of the men in the ranks. Great care should be taken in selecting boys for apprenticeship. Machines inevitably depreciate, but men if properly cared for appreciate in value. In order that time and money shall not be wasted on boys who are not adapted for railroad work there should be a six months probationary period before apprentices are finally accepted.

A special effort should be made to retain graduated apprentices in the service of the company. This can be brought about in most cases, by work-

ing them into the organization wherever possible, that is, in places where they will be in line for promotion.

It is generally conceded that the system whereby each apprentice receives four hours of school instruction per week divided into two periods of two hours each during working hours and with pay is the most satisfactory. A certain amount of home problem work should also be required. In the schoolroom the apprentice should be instructed from models as to shop practice and taught the principals of the steam engine and valve setting. He should also become familiar with the company's standards. The work in mechanical drawing should be made as practical as possible and the drawings made by apprentices should be used for shop use when consistent. More attention should be given to shop sketches than the finished mechanical drawing.

These classes tend to bring the apprentice in closer touch with the organization, and make him realize that he is of some importance in its workings. The school be open at noon hour, and the instructor should be there at that time so that the especially ambitious boy may receive help. A part of the time the air brake instruction car should be devoted to the teaching of shop apprentices.

By all means there should be a shop instructor as the ordinary shop does not have sufficient supervision to take care of this instruction. A shop instructor with the required enthusiasm, will almost at once increase shop output as it is sometimes marvelous the work that can be turned out by a bright apprentice boy when he has received proper instruction, and has been started right on a job.

In order to insure a thorough training, and to give the necessary variety of work it should be the duty of the shop instructor to see that the schedule is followed; granted there is some flexibility to the schedule.

The work of apprentices should be graded, and for a matter of record and for reference the shop and school instructors should prepare a monthly report, jointly.

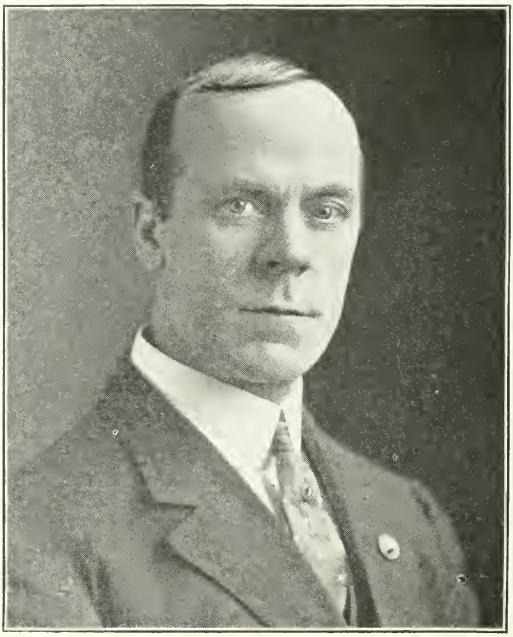
There is no question but that the modern shop with its unlimited facilities does not turn out the all around mechanic that were common in the days of the back number shop with its poor equipment. In order that the ingenuity and resourcefulness of the apprentice may be developed to some extent, he should be required to spend a few months of his time in the roundhouse or a back shop not equipped with modern facilities.

Mr. Logan: I have been told at Topeka they had one apprentice to every five journeymen.

Mr. Thomas: The ratio is one to four.

Mr. Gardner: I note in the committee's report under Question 10 "Subjects taught in the schools" there is no mention of shop practice under railroad schools; although this is mentioned in "other corporations" this was probably an oversight, since we make shop practice very prominent. The school work must not be too academic; setting valves with models, lining guides, laying off shoes and wedges, etc., are taught in the school room. We have reduced the drawing and tracing, particularly the tracing to a minimum. Instead, sketching from real blue prints, reading working drawings, spelling and sketching locomotive and car parts are substituted.

Too much emphasis cannot be placed upon the knowledge of our apprentice boys and their characters, so ably brought out by Mr. G. M. Basford in his recent talk to the apprentice instructors of the Santa Fe. It is not enough to train our apprentices, but we must study them, know their habits and capabilities and place them accordingly. On the N. Y. C. we have just established a system of reporting every prospective graduate two weeks before his time is up; this report gives his qualifications and his character, and is sent to all shops requesting replies stating whether this man is needed at that point. In this way graduates who might fail in finding immediate employment in the home shop for want of a vacancy would be retained permanently in the service. We must retain our boys and give them a journeyman's rate if the apprentice system is to enjoy continued success. It is true, however, that some of the boys who leave return to the home shop, after trying several other jobs, improved and broadened by their contact with the world.



W. T. Gale, Fourth Vice-President

I want to make a plea for all general foremen to visit the apprentice schools in their shops. It is not necessary to make any speeches or answer any questions,—just run in and out again once a week and thereby impress your support and endorsement of the work upon the boys and instructors. I know it is hard for a busy foreman to find the time to do this, but the return upon the time thus invested will be very great.

There are many ways in which the scope of our apprentice work may be extended and broadened; for example, we have just started a co-operative arrangement between the car and locomotive departments whereby the electrician apprentice in each department are transferred for three months from one department to the other. This gives the boys an opportunity for much wider experience in their line of work, resulting in mutual benefit. This is only a beginning. Eventually similar transfers of boys working in other allied trades may be accomplished.

We have made a new move in the school end of the appearance work in the N. Y. C. and that is the introduction of some of the lessons books published by the International Correspondence Schools. Some criticism of this feature has been offered to the effect that the texts of these books are not directly applicable to locomotive and car work. But we think that the use of the I. C. S. books, temporarily, until such a time as we may have all of our own trade courses completed, is a great benefit. These books, or pamphlets, are bought outright and belong to the railroad company. The I. C. S. people have no part in our apprenticeship system. The boys like the books. They are printed, which emphasizes their importance, and they contain a great many interesting and instructive cuts.

Mr. Holmes Beckwith in his report on industrial education recently issued by the U. S. bureau of education, writes as follows:

"Apprenticeship as conducted today furnishes the best training for supplying skilled workmen in the trades. He reviews the purpose and need for vocational, technical, industrial and trade schools, but none of these really solves the problem as does our apprenticeship system."

He states in conclusion that "No better way, or even as good, has yet been devised for the main training of the masses of industrial workers than in the shops where they are employed, and instructed by those who supervise their work."

Mr. Reyer: I would like to ask if you have a certain age at which you take the boys?

Answer: The age limit is 17 to 21. No one under 17.

Question—Do they have to have an education?

Answer—There is an entrance examination which is not very severe, bearing in mind that we are trying to get boys to learn trades and not to teach school and we are very easy with the education. If they are able to absorb, we give them a medical examination and take them.

Question—Can a foreman excuse a boy from lessons?

Answer—Yes, any plan would have to be with the foreman. But if they interfered too much they would hold the boy out; also the instructor has the right to call the attention of the superior officer to it.

Question—Can an instructor discipline a boy?

Answer—Yes, and no. It is understood that a boy is to conform to certain rules, and he will usually do what the instructor tells him if it is fair, because he knows that the decision of the instructor will be upheld by the foreman. They are under the discipline of the local organization. The instructor can lay him off and the general foreman will support him.

Mr. Thomas: They select them at a minimum age of 16 and maximum 22. It is pretty hard to take a boy 21 and pay him the small wages paid an apprentice boy. After a man becomes that age he hates to work for such low wages. We have what we call an apprentice board, composed of general foremen, truck foremen of the department shop, instructors and school instructors that pass on all such matters pertaining to the apprentices. We are not allowed to lay them off. If a boy is home a week, he has to serve that much longer. We have a contract that we will teach him a trade and give him an opportunity. They do not work more than 10 hours. If the shop works 8 hours, they work 10. We pay them from $1.00 to $1.25 a day, and

they get an increase every six months. They have to serve 10 hours a day, 25 days in the month, 3,000 hours a year. The apprentice board will say: "Keep your eye on that boy; you ought to be able at the end of 6 months to tell whether that boy should choose a trade. If he does not believe the boy will make a good mechanic he tells him so. It requires just as much brain to make a mechanic as any other trade. This apprentice board meets and passes on the boys every six months to see whether they are fitted for that trade, and if a boy is not, they try to determine what he is fitted for.

The general foreman, the machine foreman and the gang foreman, the shop instructor and the apprentices' school instructor have full authority. The general foreman cannot dismiss a boy. The shop superintendent signed an agreement to keep the boy, and he is the only person who can break the contract, but if the foreman recommends that a boy be discharged, he is generally discharged. If the board recommended a certain thing, I would have no authority.

Mr. Reyer: Can you withhold his raise every six months?

Answer—No, the rate is a public rate.

Question—After his time, does he go right into mechanic's pay?

Answer—Yes, full rate. Whenever they graduate they give a diploma and $133.

President Scott: We have one more paper bearing on the subject, written by Mr. W. L. Dickert.

MACON APPRENTICE SCHOOL. C. OF GA.

By Mr. C. L. Dickert

The Central of Georgia Railway Company's apprentice school at Macon, Ga., Shop was organized August 1st, 1912, under the direction of Mr. D. C. Buell, Chief of the Educational Bureau of the Union Pacific Railroad Company, Illinois Central Railroad Company, Yazoo and Mississippi Valley Railroad Company, and the Central of Georgia Railway Company.

This school as well as several others similarly designed and operated under the same management on the Illinois Central, developed from the fact that there was a shortage in available mechanics competent to take responsible and well paying positions, and a principal object was to train men in accordance with shop ideals and standards so that when vacancies did occur competent men could be taken from the ranks to fill them.

The total enrollment is 75. Several of these included in the total enrollment are messengers used in the shops and several others are rivet heaters in the boiler shop.

One half hour each day is devoted to class room work, the Apprentice being paid for that time and his attendance made compulsory. The subjects, Mathematics and Reading Working Drawings, are taught on alternate days. The enrollment is divided into nine classes, each class reporting every thirty minutes, from 7:00 to 9:00, and from 9:30 to 12:00.

This half hour period every day is contrary to the period of most apprentice schools, most of them having two hour periods two or three times a week. It was not adopted, however, for convenience, but for several sane reasons. Consider the fact that nearly all grammar schools have only thirty minute periods, and the class periods of the Universities are not over one hour. Thirty minutes is about as long as a boy can be kept well interested on one subject. Other advantages of the half hour period are that the instructor can see the boy every day, keeping fresh in his mind the thought of improving every opportunity, and the classes can be made small allowing the instructor to give each boy almost individual attention.

As to the subjects taught, really the first thing necessary for the boy to know, after he learns the use of his machine and tools, is to learn to read a drawing; therefore, we give him the subject Reading Working Drawings. Mechanical Drawing is nothing he can use in the shop and while it teaches him after a while to read a drawing, it is rather a round-about way to get at it. In teaching Reading Working Drawings, the instructor makes use of a straight-edge, triangle and compasses on the blackboard, showing some of the principles of geometrical construction, also requiring the boys to use

these instruments frequently. It is also necessary in teaching Reading Working Drawings to have the students make many sketches on the boards and on paper. After completing this course a thorough study on shop sketching is taken up. When completing these two subjects, without the boy knowing it, he has really learned the biggest part of mechanical drawing, except the use of the instruments and lettering. It has been planned that in the last six months of a boy's apprenticeship he can, if he wishes, take Mechanical Drawing and learn the use of the instruments, lettering, etc., so when he finishes his apprenticeship he will not only have a knowledge of reading drawings, but he will know enough of actual drafting so that at any time he should want to start in drafting he will have the knowledge to enable him to go along and make some progress with it.

It takes a year or a little more to complete the drawing and sketching; after that time on the drawing day work is given that might be classed as specific shop instruction; that is, instruction relating directly to the work in the shop. Up to that time, the various crafts which have been mixed in classes are divided and the boy given specific instruction relating to his particular trade.

On mathematics day the beginner in the shop is started at the very beginning of Arithmetic with addition, and is so instructed that at the time he has finished the drawing and sketching he will have gone through Addition, Subtraction, Multiplication, Division, Fractions and Decimals, which are so essential to a man in the shop.

Applications for employment are rejected unless the boy has gone practically through the grammar school, but even then he is not as thorough as he should be in this part of mathematics, and a review is necessary. Shop arithmetic is carried practically through the four years as far as Trigonometry.

In addition to the work already mentioned, from time to time lessons in spelling, composition and penmanship are inserted. Also matters of general information, so that when the boy finishes his apprenticeship he has gotten something which he can use whether he becomes a mechanic, business man, or anything else on one hand, and on the other hand he will get something that will be a definite dividend-bearing asset to the shop. Half the time the generous thing is done by him, and the other half of the time he is specialized for railroad work.

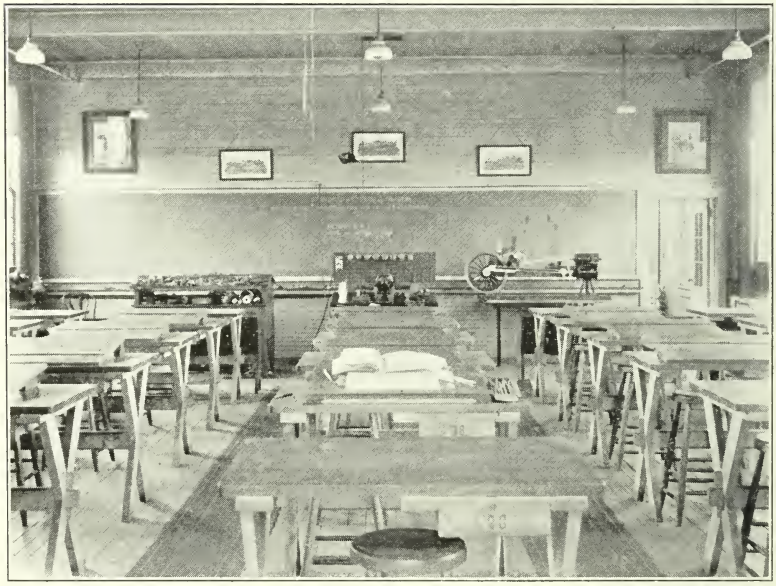
With this apprentice school the instructor has nothing to do with the boy in the shop; therefore, not interfering with that organization at all. In some cases where the Apprentice Instructor is responsible for the boy in the shop, the men in the shop seem prone to shift the responsibility of the boy and of course lose interest in him. It is the desire of the apprentice school to have the whole shop organization work in sympathy with it, and to take a more active interest in the welfare of the apprentice, and to feel that they are responsible for him.

The cost of this apprentice school is made very low on account of the educational bureau having charge. The Educational Bureau can do all the text book writing and work of that kind without putting on any extra force and without much other additional expense. The cost per apprentice per year is $20.00.

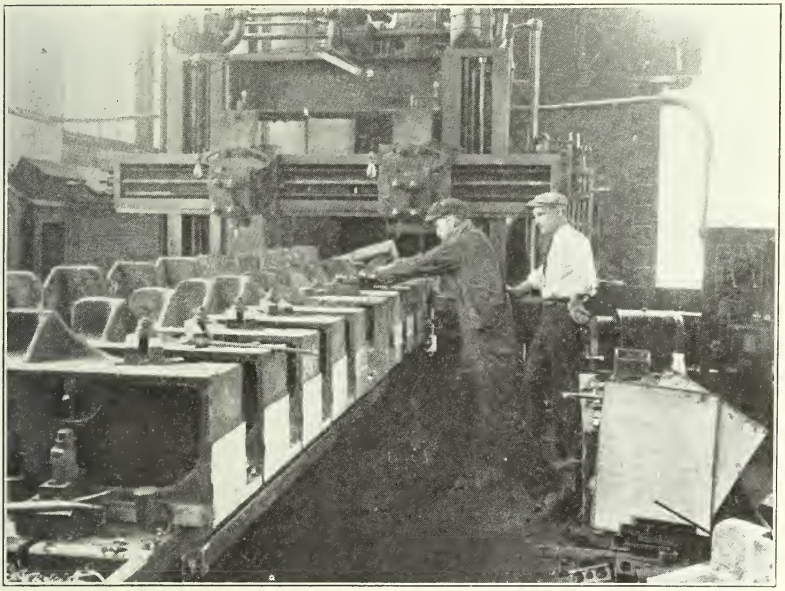
President Scott: We are particularly fortunate in having with us, in addition to the gentlemen who have already spoken on the subject Messrs. Jones, Hughes and Yoder, instructors on the Pennsylvania Road at Altoona, and we would like to hear from them.

Mr. Yoder: I do not know that I have anything to add, but I might show what we are doing on the Pennsylvania. We organized the system about three years ago at Altoona, starting with 180 boys in September, 1910, and by the end of July, 1911, we had 240. This year it closed with 277 at Altoona and we have schools at Philadelphia, Wilmington and Harrisburg; Pittsburgh 38, Harrisburg 19, and Wilmington 19. Our school instruction system is probably similar to the one described by Mr. Cross of the New York Central. We give them four hours' instruction each week; two hours' drawing and two hours' recitation work. We teach them to read blue prints and at the same time give them instruction in drawing, so that those who are

No. 7. This shows the school room of the Westinghouse Electric & Manufacturing Company with a class in mechanical drawing in session.

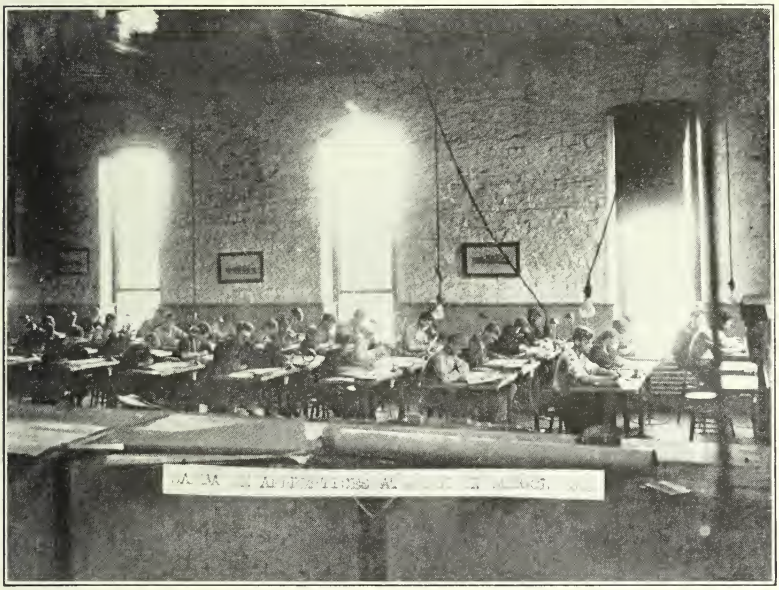


No. 9. This shows the Drawing Instruction Room, Altoona Apprentice School, Pennsylvania Railroad Company.



No. 43. This shows an apprentice at work on a planer at the plant of the American Locomotive Company, Schenectady, N. Y.

No. 44. This shows a modern school room on the Santa Fe Railway at Topeka, Kansas. There are 223 apprentices at this shop and a total of 801 on the system.



No. 48. This shows a class in session at the Topeka shops of the Santa Fe Railway.

SANTE FE RAILWAY -- TOPEKA SHOPS

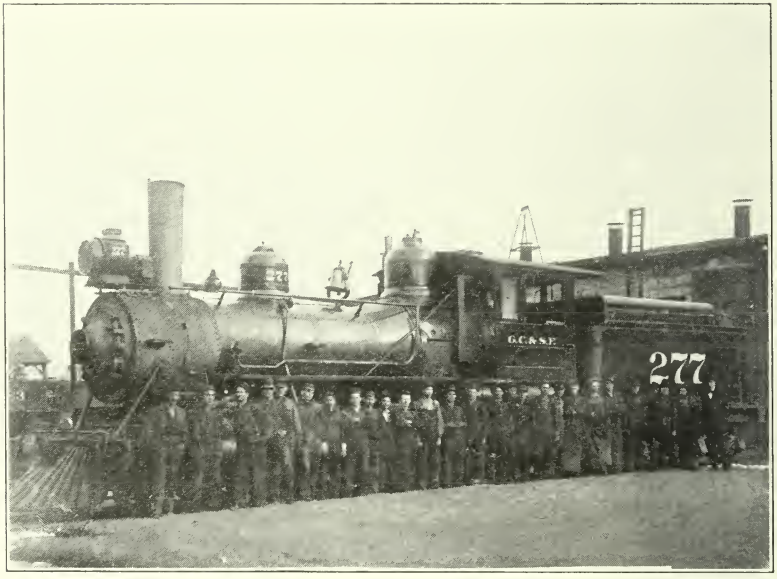
Repairing One Set of Links

An Apprentice after serving 3 years and 9 months with six weeks experience on this class of work, was assigned the repairing of links for engine No. 1085, a heavy Prairie type, radius 58 inches, back set 1 inch, and did the following work on links:

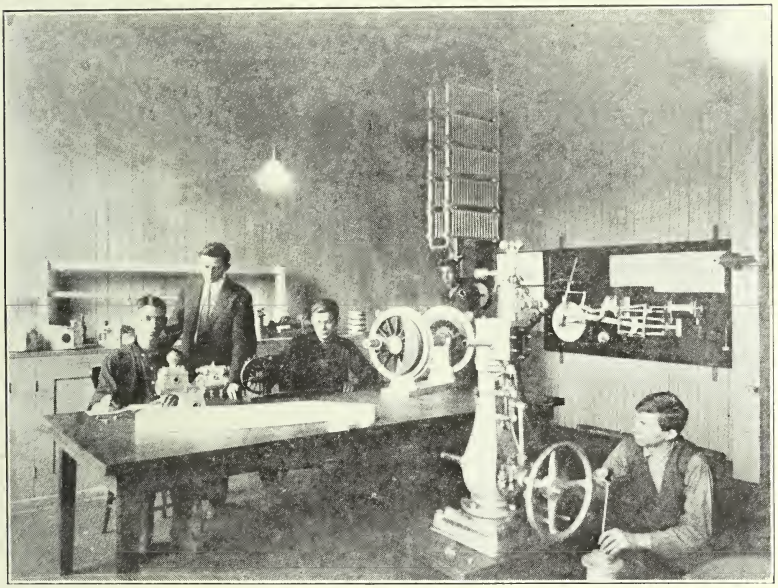
2 new block pins and nuts, 2 new top lifter pins and nuts, 2 new front motion bar pins, 2 new hanger pins, 2 new saddle bolts, 2 new bushings for blade bolts, 2 new saddle bushings, 2 new saddle washers and nuts, 4 new motion bar bushings, 2 blocks bored out, 2 saddles turned, 2 link blocks filed to radius and closed in, 4 blade jaws closed and filed to fit links, 4 blade jaws laid off for drill and reamed for bolts, 2 blocks riveted together, 2 link hangers taken down, frame studs put in, and hangers put up. Put on saddles. Put on two new oil cups. Squared up 2 lifters. All bushings pressed out and new ones pressed in. All pins and nuts laid off to be drilled for cotter keys. All bushings laid off to be drilled for oil holes. All pins case hardened, polished, and put in place. Link saddle, blocks and plates hardened and polished. Actual time 21.5 hours, schedule time 26.0 hours.

No. 45. This shows a record of the performance of one of the apprentices of the Santa Fe at one of the shops on their system.

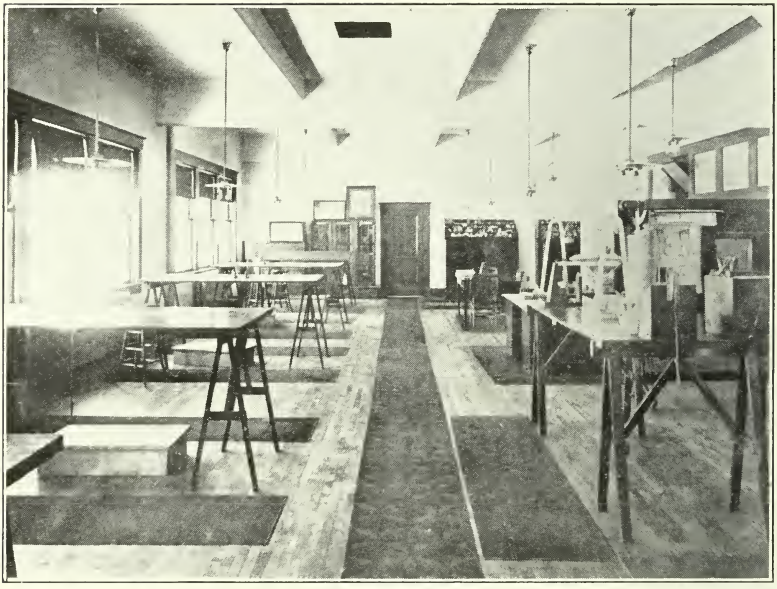
No. 47. This shows the apprentice band at the Topeka shops of the Santa Fe Railway. There are 33 apprentices in this organization.



No. 51. This shows an engine and group of apprentices on the Santa Fe Railway. This engine was overhauled entirely by apprentices.



No. 66. This shows the mechanical laboratory adjoining the school room at the McKees Rocks shops of the P. & L. E. Ry., and contains working models, used in connection with the regular lesson papers. There are 53 apprentices at this shop.



No. 67. This shows the apprentice school room at the Beech Grove shops of the C. C. C. & St. L. Ry. (Big Four) and includes the drawing tables, lesson paper cabinets, model racks, etc. There are 97 apprentices at this shop.

No. 68. This shows the school room at the Collinwood shops of the L. S. & M. S. Ry. with a class in regular session. There are 111 apprentices at this shop, and a total of 761 on the New York Central Lines. Apprenticeship training is conducted at 16 shops on the Lines in which the apprentices are given school training during working hours while under pay, as well as the shop training by regular shop instructors.

capable and will eventually make draftsmen will follow that line. We take out the best and encourage them along this line. We do not want to carry this too far or we would overstock the drafting room. The primary object is to make shop men and not draftsmen. The work in mathematics starts with addition, if they require it. If they have a high school education, you can start them higher up. They serve four years in the shop; we take them three years in the school and the fourth year they do day work in the shop which would interfere largely with school instruction.

We think this is the best arrangement for our system. We have a compulsory attendance and we require them to be there every day, unless for sickness or some other cause. If absent, they will be disciplined accordingly. We think the system is a perfect success because it gives greater loyalty. We do not have any shop instructors as yet, although we agree that they are a very important part of the apprentice system. When relying upon the foreman to see that the apprentice boys are trained, of course a failure upon the part of the boy falls back upon the foreman, and he sees to it that the apprentices are instructed properly.

Mr. Hughes: I do not think of anything to add to what has already been said. But I will be glad to answer any question you might ask.

Mr. Jones: There are just a few things appear to my mind. It seems to me one of the most important things is efficiency. On our various systems we are developing efficiency, and the railroads are going to pick out the best men in their employ, and it is the younger generation that will possess this efficiency, developed through our apprentice system to the best of our ability. In addition to the course that Mr. Yoder has spoken of, we have started a course in the making of iron and steel and in dynamic static electricity.

President Scott: Our convention voted to give the subject of the apprentice system a period of one day, and we certainly could not have been given any better talent to demonstrate it. It is up to the members to become familiar while we have the authority here. Ask any question and discuss these points that have been brought out.

Mr. Gale: After listening to the various papers read by the members of the committee, and being somewhat interested personally in the apprenticeship question, I have come to the conclusion that the subject has been covered in such an ideal and proper manner that there remains but very little for discussion, but possibly from an intelligent standpoint of view, the series of questions from those who are not instructed in regard to the various plans or systems that have been put in operation by the railroads mentioned in the papers, have been most interesting. The subject ought to be very interesting to all railroad men, as we naturally take great pride in our railroad, and feel that we would like to have those who follow after us take equal pride and meet with equal success, if not greater than we have in our chosen calling. We should ask, if we do not know, as to the best methods that might be employed in our various localities, with the varying conditions that exist in the different localities of the country. It is not convenient possibly for all railroad companies to adopt the same plan, or the same scope, as the New York Central lines, the Pennsylvania and the Santa Fe, but we can, however, be interested and add a little towards the education of the young man. We need to educate our young men in these progressive days along mechanical lines; we owe it to ourselves, our company and the public to give the best service that lies within our power. I have had a little to do with the Apprentice system on the Chicago Northwestern. It is not as complete there as it should be. Our officials are imbued with the idea just as strongly as any officials on the other railroads that it is necessary to educate our apprentices, and we have a plan which I presume is familiar to the gentlemen present. There is nothing compulsory as far as the educational part is concerned outside of the schedule we have in the shops, which pertains to the education of the young men in their particular trades. We have at the C. & N. W. shops what is called a shop demonstrator, and under his jurisdiction comes the apprentices. He has the matter of arranging the schedule of the apprentices as they pass through the shop. The demonstrator also has a shop instructor, a man who is a mechanic, who posts the boy in the various

duties that they must perform per their schedule, and in that manner we, to a certain extent give them a certain amount of education. Still it is not as complete as it might be, and as I presume it will be, because, as I have stated, our officials are interested and they are going to do something along the lines similar to what have been laid down here today.

However, the point I wanted to make is this: that a great deal can be done for the boys under your jurisdiction by a little personal interest and along the proper lines. You can put yourself in the position of a father, as I might term it, as well as a general foreman. You can encourage them by words of advice, and get them together along ideas of advancing themselves. As, for instance, sometime ago, through the efforts of one of our officials, a number of our apprentices were gotten together and induced to attend night school, and they got quite a class. They organized about 55 out of a total number of 75, and those boys took quite an interest in the work in that night school. Of course it requires a great deal of personal effort upon the part of those interested to keep those boys together under conditions of that kind, and I have always been in favor of compulsory education during their working hours. I have advocated this, I might say, time and time again, and I am satisfied that sometime in the near future the apprentices on the Northwestern system are going to have a plan similar to what has been spoken of here this morning. I advanced this idea for the benefit of those present who possibly have had but little to do with the subject. As far as the discussion is concerned, it seems to me that there is none. The paper is so ably written and so well read.

President Scott: I agree with Mr. Gale. I believe it is very complete in every respect. I am sorry that Mr. Pickard is not here owing to illness, because I know he took considerable personal interest in the apprenticeship question, and if not asking too much I would like to have the gentlemen come here tomorrow noonand bring his lantern and we will have these slides gone over again. And to those of you who are located in Chicago I think it would be well for you to try to get your apprentices up here. We are not entirely satisfied with the attendance this morning when these slides were being demonstrated. I know it will be educational and appreciated by all.

I do not want to take up any more time on this subject unless there are some questions to be asked. If there is nothing more, we will close the subject.

Mr. Thomas: There was a question raised in regard to the high school boys. A large majority of the high school boys seem to think that they want something better than the shop. The average good mechanic in the shop is afraid of them. We prefer in our shops to educate the boy. I am sorry to say that the boys acquire some ideas in the high schools that unfit them for work. Our apprentice schools on the Santa Fe are a part of the shop organization. Our Master Mechanic and General Foremen never fail to visit the schools and see what is being done by the boys. Another thing, our vice-president has shown that the men we are creating are better fitted for leadership and for foremanship than any one we can hire. They are trained in our methods and are familiar with our standards. In the future any foreman, or gang foreman, or master mechanic, must be made from the men already in the employ of the Company, and the preference is given to the graduate apprentice. I say this to show that our officials have charge of the road; they talk over the best returns they can get and are satisfied that there is less friction in our shop to have a shop instructor. The foremen are always glad to have them. It relieves them of a great deal of work that the boys can do. Our General Foreman tells me that he does not know what he would do without the shop instructor. Sometimes the shop instructor is away to a meeting, or vacation, and in a day or two I begin to hear a howl. "We are working ourselves to death keeping our work up and looking after the apprentice boys."

That is the way our shop officials look at the apprentice boys. They are proud of the apprentice system. Any official who comes to the shops — the first place they take him is to the apprentice school, and they take him out in the shop and show what they can do.

We will be glad to give you any information as to how they handle the matter.

Mr. W. Smith: The great problem that confronts motive power officials. at the present time is not so much a matter of better shops and facilities or even of better methods, as it is with men. Its solution is largely a matter of recruiting and raising the level of the men in the ranks. Great care should be taken in selecting boys for apprenticeship. Machines inevitably depreciate, but men if properly cared for appreciate in value. In order that time and money shall not be wasted on boys who are not adapted for railroad work there should be a six months probationary period before apprentices are finally accepted.

A special effort should be made to retain graduated apprentices in the service of the company. This can be brought about in most cases, by working them into the organization wherever possible, that is in places where they will be in line for promotion.

It is generally conceded that the system whereby each apprentice receives four hours of school instruction per week divided into two periods of two hours each during working hours and with pay is the most satisfactory. A certain amount of home problem work should be also required. In the schoolroom the apprentices should be instructed from models as to shop practice and taught the principals of the steam engine and valve setting. He should also become familiar with the company's standards. The work in mechanical drawing should be made as practical as possible and the drawings made by apprentices should be used for shop use when consistent. More attention should be given to shop sketches than the finished mechanical drawing.

These classes tend to bring the apprentice in closer touch with the organization, and make him realize that he is of some importance in its workings. The school be open at noon hour, and the iustructor should be there at that time so that the especially ambitious boy may receive help. A part of the time the air brake instruction car should be devoted to the teaching of shop apprentices.

By all means there should be a shop instructor as the ordinary shop does not have sufficient supervision to take care of this instruction. A shop instructor, with the required enthusiasm will almost at once increase shop output as it is sometimes marvelous the work that can be turned out by a bright apprentice boy when he has received proper instruction, and has been started right on a job.

In order to insure a thorough training, and to give the necessary variety of work it should be the duty of the shop instructor to see that the schedule is followed; granted there is some flexibility to the schedule.

The work of apprentices should be graded, and for a matter of record and for reference the shop and school instructors should prepare a monthly report, jointly.

There is no question but that the modern shop with its unlimited facilities does not turn out the all around mechanic that were common in the days of the back number shop with its poor equipment. In order that the ingenuity and resourcefulness of the apprentice may be developed to some extent, he should be required to spend a few months of his time in the round house or a back shop not equipped with modern facilities.

President Scott: I want to thank you gentlemen who have so ably presented the matter this morning and the display which we have taken such great interest in.

We will now declare the subject closed.

William Hall, Secretary and Treasurer

SHOP SCHEDULES TOPIC No. 3

The following paper was read by Mr. Gardner:

Topic No. 3.—Shop Schedules, by Henry Gardner, N. Y. C. & H. R. Ry. Part 1. General Outline of the Work.

Scheduling and routing work in a railway repair shop is not new. These methods have been and are used successfully on the Chicago & North Western Railway, The Atchison, Topeka & Santa Fe, the New York Central, the Lake Shore & Michigan Southern, the Boston & Maine, the Canadian Pacific, and in a more or less modified form on many other roads. The system described in this paper is the same as all others in principle but quite different in design and application. It was introduced into the West Albany Locomotive Repair Shops of the N. Y. C. & H. R. R. R. Company in January, 1912.

This Scheduling System is essentially practical and thereby differs from many other widely advertised dispatching and routing systems. It is simple and flexible and maintained by the regular shop force and it does not displace any portion of or the arrangement of the existing organization and does not antagonize it in any respect. Every feature of the work is fully under the jurisdiction of the local shop management and is not subservient to any outside agency. No so-called efficiency engineers are necessary to introduce these methods but there is one absolute necessity, the whole scheme must be supported generously and enthusiastically by the management; not only the Foreman and the Shop Superintendent, but the Superintendent of Motive Power and the General Manager must give it their endorsement and approval.

The fundamental principles of this system have been very extensively and profitably used in manufacturing and industrial plants and there is no tenable reason why these self-same methods cannot be applied to railroad repair shops. The transportation department of a railroad depends upon the exact adherence to a train schedule which tells the arrival and departure of every train at every station on the line. A railroad shop, no more than a train, can be operated to realize maximum efficiency without clearly defined scheduling and routing plan and it is strange, that with this perfection of system in one department, another department still uses the same old methods.

The usual argument made by the railroad officials against the adoption of these up-to-date principles is that the cost of clerical or non-productive labor is much greater than the benefits derived and money saved. These objections have been entirely disproved and overruled at West Albany on account of the low cost of clerical help and the simple and practical nature of the work. It has been further argued that repaired material cannot be successfully scheduled especially when manufacturing work is done in quantities for outside shops and engine houses but this can all be provided for by setting aside certain machines and men, if necessary, for this work. At West Albany a leading man is detailed to supervise the manufacture and delivery of all material to outside points. Such work is not dated or scheduled and it can be run through a shop using the scheduling system just as easily as an extra or special train may be run over a division without altering existing timetables. This whole matter does not present an obstacle of any weight if the spirit is ever present to make the new system a success.

"Scheduling" means listing in order of dates or naming in consecutive order. "Routing" means determining the path or route over which material will travel in its natural course through the shops. After determining the route of a part it is scheduled; that is dates are set for each stop and start that the part makes from the time it leaves the Erecting Shop until it returns again ready for completing the engine. The problem of scheduling and routing then resolves itself into providing a proper predetermined date or day of the month when each part, or group of parts, will arrive at and leave the various departments comprising the path over which it is to travel and finally arrive at the Erecting Shop when wanted for completing the engine. In the same manner the principal operations necessary to assemble the engine in the Erecting Shop are also subdivided and given dates in proper order for its completion.

In most railroad repair shops the date for the delivery of the entire engine is all that is planned ahead but why is it not just as necessary to plan

ahead a date for the cab or the wheels? Will not the same principles of foresight and preparedness hold good in either case? When this planning ahead is not done more or less confusion must exist especially in the large shop. Frequent delays occur and a delay in one department will usually counteract all the good work of every other department. Parts are misplaced, sidetracked or forgotten, for days and sometimes weeks; suddenly when the engine is nearly finished someone discovers that one or another piece is missing and the result is a general hunt, oftentimes unsuccessful, to locate this part and rush it through in order to deliver the engine on the promised date.

The Schedule Office should be centrally located preferably in the center of the Machine Shop and close to the foreman's office. One competent man with shop experience and an assistant for office work and checking is all the force required with this system to route and schedule successfully all the principal operations and material for repairing 90 engines a month. If the shop is a small one not requiring the full time of a special man for this work the forms used may be made out by the foreman or sub-foreman.

Part 2. Blank Forms.

The first step in introducing this system is to prepare route sheets showing the course of all the material to be scheduled through the various departments. The second step is to determine the number of days to allow engines to remain on pits while undergoing each class of repairs. For example, a Pacific type engine may be given 24 days on pit for a class A, B or C repairs and if it is to get a normal "D general" repair 18 days are allowed; if "E" repairs, 14 days; if "EF" repairs, 10 days and "F" repairs, 6 days. Another engine, a switcher, may be given but 14 days for a D-general repair since there are less and lighter parts to handle. These figures are generally used at West Albany but cases may arise where an allowance of 20, 16, 12 or 8 days will better suit the conditions.

Schedules must necessarily be flexible but once a schedule is made out for an engine it should not be revised unless there is a complete change in the nature of the repairs. The condition of the shop and the demand for the power will, of course, influence the selection of a proper schedule. The best way to determine the number of days allowed is to average the days on pits for each class of repairs for several years back; then, to start with, take off two or three days from these figures to represent the increase in efficiency due to the improved methods. In some shops the time on pits is based upon guesswork or upon a date which may be set to conform to the needs of the division Superintendent or some other official. Often we find the number of repairs fixed by the amount of money allowed the shop for the month; such practices are very inaccurate.

About 25 forms are at present used by this new system at West Albany and as there is not space here to describe them all I have shown five representative types, these are named: the Schedule or Constant Sheet, the Repair Card, the Check List, the Delay Sheet and the "Tickler" Sheet. For each engine scheduled there are 15 repair cards, three check lists, two delay sheets and one tickler sheet. Besides these there are three or four other forms of minor importance.

M P 461

N. Y. C. & H. R. R. R. Co.
M P DEPT
SCHEDULE OFFICE
ERECTING SHOP REPAIR CARD
OPERATIONS
ISSUED TO SCHEDULE SHEET

SCHEDULE NO 2
ENGINE NO
CLASS OF REPAIRS D
DATE TAKEN IN 191
DATE TO LEAVE 191
TIME ALLOWED 18 DAYS
SERIES 7-1-12

CLASS OF WORK	DATE WANTED		REMARKS
ENGINE IN SHOP UNWHEELED	0		
BOILER IN SHOP MOUNTED	—		
ENGINE STRIPPED MATERIAL DELIVERED	2		
BOILER TESTED (WATER)	2		
VALVE BUSHINGS OUT SIZES IN M ⊕	5		
BOILER FITTINGS APPLIED	9		
BOILER TEST (FIRE) BOILER WORK (O K)	—		
CAB AND RUNS UP	—		
MAIN RODS UP VALVES SET	15		
BRAKE RIGGING O K	16		
SMOKE BOX WORK O K	17		
PIPE WORK O. K SIDE RODS UP	17		
ENGINE OUT	18		

FIG. 1

Fig. 1 shows the headings and a few lines of a schedule or constant sheet for Erecting Shop operations. It is plain that since but very few engines will carry the same dates we must have a key or master sheet which does not give actual dates but instead numbers representing the number of days allowed for each operation. For example. the O at the top of the second column means that the engine is wanted in the shop and unwheeled O days after arriving on the pit which is, of course, always that same day. The number 16 after "brake rigging O. K." means that 16 working days after the engine is placed on the pit the brake rigging must be up and finished. This is for an 18 day schedule; for a 10 day schedule the 16 would be 13 which is proportionately less since shortening the whole time of the engine will almost always shorten the time allowed for its material and operations.

Before making out the constant sheets it is often convenient to write out the schedule in diary form stating each day what is to be done. This form is given below for the first three days of the 18 day schedule:

18 DAY SCHEDULE

1st Day.

Engine in shop — unwheeled.

2nd Day.

Main and side rods, driving and trailer wheels and boxes delivered to Machine Shop.

3rd Day.

Engine stripped complete. Boiler hydrostatic test O. K. valves, links, motion work complete, engine truck boxes, brake rigging, engine brake cylinders and valves, air pump, engine truck wheels, boiler fittings, eccentrics and straps, crossheads and gibs, pistons and rods, shoes and wedges, steam chests covers, valve yokes, parts of spring rigging and some guides all sent from Erecting Shop to Machine Shop. Frame binders, engine springs and some guides sent from Erecting Shop to Smith Shop. Ash pan delivered to Boiler Shop, etc., to 18th day engine out.

M. P. 466

N. Y. C. & H. R. R. R. Co.

M. P. DEPT

SCHEDULE OFFICE

MACHINE SHOP REPAIR CARD

ISSUED TO E. Dreon FOREMAN

SHOP D
SCHEDULE No. 2
ENGINE No. 1965
CLASS OF REPAIRS. D
DATE TAKEN IN 7-17 1912
DATE TO LEAVE 8-7 1912
TIME ALLOWED 18 DAYS

CLASS OF WORK	WANTED FROM ERECTING SHOP	WANTED IN ERECTING SHOP	WANTED IN SMITH SHOP	WANTED FROM SMITH SHOP	WANTED FROM TANK SHOP	WANTED IN TANK SHOP	REMARKS
MAIN RODS	7-18	8-1	7-30	7-31			
SIDE RODS	7-18	8-3	7-30	7-31			
VALVE BUSHINGS MACHINED	——	7-24					
STEAM CHEST OR PISTON VALVES	7-19	7-26					
ROCKER BOXES	7-19	7-30					
LINKS	7-19	7-30					
MOTION WORK COMPLETE	7-19	7-30					
DRIVING WHEELS AND BOXES	7-18	7-31					
TRAILER WHEELS AND BOXES	7-18	7-31					
TRUCK BOXES	7-19	7-30					
SPRING RIGGING	7-19	7-29	7-20	7-23			
GUIDES	7-19	7-29	7-20	7-22			
ENGINE TRAILER TRUCK SIDE PLAY	7-26	——					
DRIVING BOX SIZES	——	7-26					
ENGINE FRAME	——	——	——	——			

E. F. Williams
GENERAL FOREMAN.

FIG 2

Fig. 2 shows part of a Machine Shop Repair Card used to route and date all material from the Erecting Shop to the Machine Shop and back again when finished and ready for the engine. Material routed by way of the Smith or Tank Shop, such as brake rigging parts and tender brake cylinders and valves are also carried on this form. To better explain it let us refer to the "side rods" shown in the second row from the top. Since we are now in the Machine Shop these rods are first dated over from the Erecting Shop on July 18th, next they go to the Smith Shop on the 30th, on the 31st they return from the Smith Shop and on August 3rd they are delivered to the Erecting Shop. The date that these rods should be up on the engine on the Erecting Shop Operation Repair Card as August 6th, so that this date, the third, allows two days leeway for unexpected delays. If a delay occurred anywhere along the route the daily delay report, to be described later, would state that fact and explain the cause. Each department gets a repair card similar to the one just described and carrying all of the material or operations with which it is concerned.

In many cases small repair cards are used for still further extending the dates to gang bosses and job foremen. These are made out in the foreman's office and copied from the large repair card issued to that shop. All repair cards are made out by the schedule clerk from the constant sheets already described and each repair card has its corrosponding constant sheet; the only difference between the constant sheet and the repair card is that the former carries simply numbers, as already explained, and the latter carries the actual dates. All repair cards should be returnd to the schedule office for record and file after the engine goes into service.

4 P 489

N. Y. C. & H. R. R. R. Co.
M. P. DEPT
SCHEDULE OFFICE

SMITH, BOILER, TANK & CAB SHOPS

MATERIAL CHECK LIST 191

SHEET

ENGINE No	DAYS LATE	MATERIAL	WHERE DUE	REMARKS
		VALVE YOKES	M S	
		MAIN & SIDE RODS	M S.	
		ENGINE BRAKE RIGGING	M. S	
		SPRING RIGGING	M S	

FIG. 3

Fig. 3 shows the headings for a Material Check List as used in the Smith, Boiler, Tank and Cab Shops. Each department has one of these lists since it is imperative to check every piece of material or operation which is scheduled. The assistant in the schedule office takes the list sheet each day and visits all departments, marking the engine number and days late, if any, against the items printed on the sheet. The shop where the part is due is also noted in the fourth column. In the "Remarks" column the checker writes the cause for the delay, if any, and the date promised for delivery.

M P 489.

N. Y. C. & H. R. R. R. Co.
M. P. DPT.
SCHEDULE OFFICE

MR. E. V. Williams
GENERAL FOREMAN

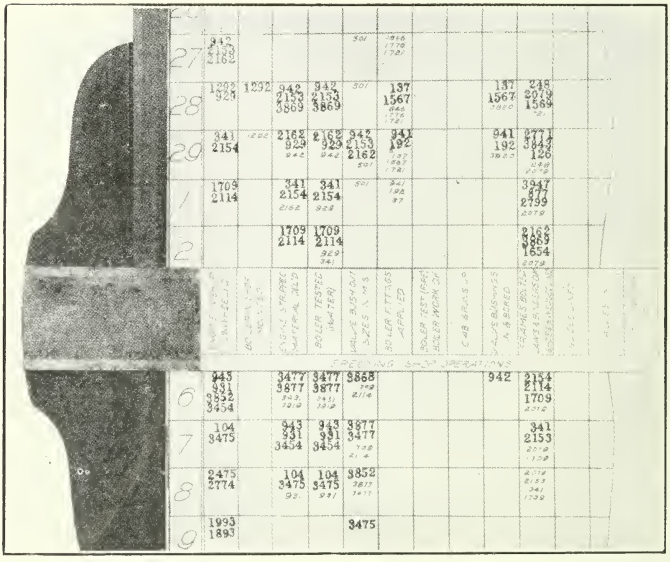
July 24th 1912

PLEASE NOTE STATEMENT OF FINISHED MATERIAL
LATE IN DELIVERY TO DATE:

ENGINE NO.	MATERIAL	WHERE DELAYED	DAYS LATE	REMARKS
382	Side Rods	M.S.	XXXX	no brasses in stock
500	Main "	" "	XXX	new in Smith Shop
1296	" "	" "	XX	waiting for Keys promised 7-27
"	Piston Valves	" "	XX	waiting for rings promised 7-25
3494	Motion work complete	" "	XX	new links in S.S. promised 7-26
132	Driving Wheels & Boxes	" "	X	one new Center promised 7-25
188	Trailer " " "	" "	XX	waiting for side play S.S.
742	R. Engine frame	S.S.	X	poor weld promised 7-25
1150	Ash Pan	B.S.	XXX	new pan no stock promised 7-27
1001	Tender due for Engine	T.S.	XX	wheels read D Eng House

FIG. 4

Fig. 4 shows a Material Delay Sheet which is printed on pink paper to accentuate its importance and to distinguish it quickly from the repair cards which are printed on yellow paper. This sheet, with its mate, the Operation Delay Sheet, is filled out from the check list by the schedule clerk each morning and sent at once to the office of the Superintendent and General Foreman. The delay sheet tells the whole story in a nut shell; what material or operation is late, to date, where it is delayed and how many days; giving the cause of the delay and the promised delivery date. The General Foreman with this report in his hand can visit each department and locate all delays in an incredibly short time; after this he can devote his time to supervision and minor duties.



Detail Corner of the Dispatch Board

M P 442

N. Y. C. & H. R. R. R. Co.

M. P. DEPT.

SCHEDULE OFFICE 191

MR.

GENERAL FOREMAN

PLEASE NOTE STATEMENT OF **MATERIAL** AND **OPERATIONS** DUE TO-DAY

ENGINE No	ERECTING SHOP OPERATION	ENGINE	MACHINE SHOP MATERIAL	WHERE DUE	ENGINE No.	SMITH, BOILER, TANK AND CAB SHOP MATERIAL	WHERE DUE
	ENGINE IN SHOP UNWHEELED		MAIN RODS			VALVE YOKES	M S.
	BOILER IN SHOP MOUNTED		SIDE RODS			MAIN AND SIDE RODS	M. S
	ENGINE STRIPPED MATERIAL DELIVERED		VALVE BUSHINGS MACHINED			ENGINE BRAKE RIGGING	M S
	BOILER TESTED (WATER)		STEAM CHEST OR PISTON VALVES			SPRING RIGGING	M S.
	VALVE BUSHINGS OUT SIZES IN M. S		ROCKER BOXES			GUIDES	M S
	BOILER FITTINGS APPLIED		LINKS			ENGINE FRAME	M S
	BOILER TEST (FIRE) BOILER WORK (O. K.)		MOTION WORK COMPLETE			ENGINE SPRINGS	E S
	CAB AND RUNS UP		DRIVING WHEELS AND BOXES			FRAME BINDERS	E S
	VALVE BUSHINGS IN AND BORED		TRAILER WHEELS AND BOXES			TENDER BRAKE RIGGING	T S
	FRAMES BOLTED JAWS AND BINDERS (O. K.) SHOES AND WEDGES LINED		ENGINE TRUCK BOXES			TENDER SPRINGS	T S.
	CYLINDER BOLTED TO FRAMES AND BOILER		ENGINE BRAKE RIGGING			ASH PAN	E S
	FRAME RAILS BOLTED MOTION CROSSTIE UP		ENGINE BRAKE CYLINDERS			STEEL CABS AND STEEL RUNNING BOARDS	E S
	GUIDES LINED		ENGINE BRAKE VALVES			NEW FIRE-BOX OR BOILER	E S
	VALVES IN		AIR PUMP			NEW FLUE SHEET	E. S
	MOTION WORK UP		TENDER BRAKE CYLINDERS AND VALVES			NEW SIDE SHEET	E S.
	SPRING RIGGING UP ENGINE TRUCK (O. K.)		ENGINE TRUCK WHEELS			TENDER TANK	T S
	ENGINE WHEELED		TENDER WHEELS			TENDER DUE FOR ENGINE	ON FARM
	FLUES SET		BOILER FITTINGS			CAB. RUNS AND PILOT	E S
	DRY PIPE IN BOILER TEST (WATER)		ECCENTRICS AND STRAPS				
	BOILER WORK O. K		CROSSHEADS AND GIBS				
	STEAM PIPES IN		PISTONS AND RODS				
	BOILER LAGGED		PISTON AND VALVE PACKING				
	BOILER JACKET O. K		SHOES AND WEDGES				
	MAIN RODS UP VALVES SET		STEAM CHESTS AND COVERS				
	BRAKE RIGGING UP		VALVE YOKES				
	SMOKE BOX WORK O K		SPRING RIGGING				
	PIPE WORK O. K. SIDE RODS UP		GUIDES				
	ENGINE OUT						

FIG. 5

Fig. 5 shows the "Tickler" or daily reminder of all operations and material due. This is a very important sheet since it conveys to the Superintendent and General Foreman each morning an exact list of what should be finished or delivered upon that day, according to schedule, on all the scheduled engines in the shop. This sheet does not of course always tell what **will** happen

on that day but it reminds the foreman of what **should** happen according to schedule.

In routing parts under this system it is important to have a cross check on two or more departments. For example, parts of the spring rigging may be sent direct from the Erecting Shop to the Smith Shop, next to the Machine Shop and then back to the Erecting Shop. In this case the three foremen interested know the dates assigned for the whole route and can therefore check one another if mistakes occur in transit. All of these forms must necessarily be different for each repair shop, since no two shops will route their material exactly alike, but the principles involved will always remain unchanged.

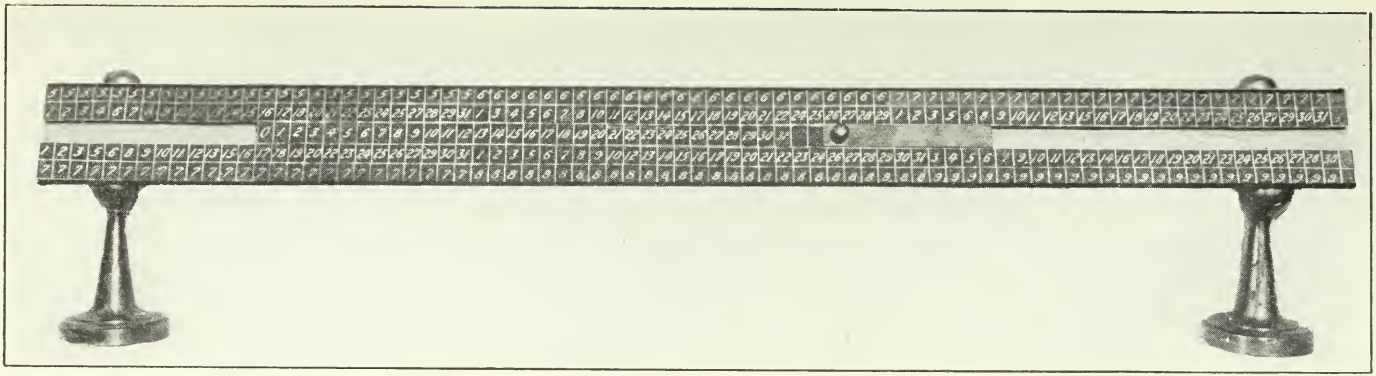
Too much importance cannot be attached to the proper supervision of the engine when stripped since the list of scheduled material depends upon the report made by the stripping gang foreman who should see that no unnecessary parts are removed and should make careful notes as the work progresses stating which parts should be repaired or renewed. This record should be sent to the schedule office and from it the repair cards will be made out. No repair card can have the full confidence of all concerned unless it is based upon exact conditions. The Master Mechanic's Report of repairs necessary should be made out and sent to the Shop Superintendent as usual and while the engine is still in service. An elaborate detailed report is not necessary since the full extent of the repairs to be made can only be accurately determined after the engine has been stripped.

Part 3. The Dispatch and Calendar Rule.

The dispatch board is the key to the whole situation in the schedule office. It is simply a board, about $3\frac{1}{2}$ x $4\frac{1}{2}$ ft. carrying a "T" square slider. On the back of this slider is pasted a paper strip carrying the names of all the materials and operations scheduled. On the slider at West Albany there are 73 items listed under the several departments concerned. The board proper is covered with paper ruled into small squares which contain the numbers of the engines scheduled. There are about 30 rows of horizontal squares, one for each day in the moth, and 73 rows of vertical squares corresponding to each item or group of material or operation as listed on the slider. It is now plain that we can readily stamp up the engine numbers in whatever little square comes in line with the date a certain piece or operation is required to be finished or delivered. When all the engine numbers are stamped upon the board in their proper squares the schedule clerk can see at a glance just where each part should be each day, when it should leave and where it should go. He can also tell when a piece is delayed in any department and how many days it is late according to schedule.

There is no information on the dispatch board which is not carried somewhere on all of the printed forms but the board record is a great time-saver through its ability to present quickly all of the data in a convenient form; it is also of great service in apportioning the work so as not to overload any one department. The schedule clerk can optionally throw the dates ahead or back to better suit the congested conditions. The board record is also valuable when drawing off data for platting curves showing the progress of the work.

When making out the daily delay reports the "T" slider is placed on the line for the day in question and by reading along the whole length of the line, first the engine number and then the material or operation, the entire report can be made out in a few minutes. Since all of the delays are posted conspicuously on the board in red ink, a preponderance of red shows at once which department, if any, is weak. The total time required to stamp upon the board all the operations and material for one engine is, for two persons working together, about eight minutes. The question is frequently asked: "How about the apparently large amount of clerical work required to find and assign all of the many dates required?" In reply we say that the "system" is worked out in the office as well as in the shop; all of the forms and the methods of filling them out are carefully systematized so as to make a minimum amount of writing and figuring.



Slide Rule Used in Obtaining the Dates

A simple slide rule is used for finding the dates. This calendar rule carries on its back the days of the month for a six month's period, Sundays and holidays omitted. The slider carries the consecutive numbers from 0 to 31 which represent the constants found on the schedule sheets and already described. When once examined this little rule is found to be very easy to understand and operate and by its use the time for writing on the repair cards all of the 278 dates required for one engine has been cut to 18 minutes for two persons working together; one to read the rule and the other to write down the dates. Every six months the rule must be recovered with the paper strips carrying the dates; the slider always remains the same.

Part 4. Shop Blackboards.

Blackboards are used in the shop in nearly every department for conveying the dates directly to the workmen interested; about 30 are now in use. These boards are ruled into columns and horizontal spaces having the words "Engine No." and "Date Wanted" at the top of the columns. On some boards it has been found convenient to put on the letter indicating the Erecting Shop wing where the engine is located and also the initials of the man to whom that particular job is assigned. The dates and engine numbers are all chalked up on the board by the shop foreman or his clerk as fast as they are received from the schedule office.

The men work to the blackboard dates, they are not at all interested in the date the engine leaves the shop; it is sufficient for them to know when their particular product is wanted. When the work is finished the workman or job foreman is only too willing to cross off the dates on the board.

The blackboard is simply an added convenience and a time-saver so that a workman can see instantly just what jobs are ahead and can figure so as to apportion them to the best advantage. It is a great incentive to the men to be constantly confronted with their dates and an engine number not crossed off on the date when the part is due is apparent to all foremen and inspectors.

Part 5. Benefits and Results.

After a trial of 15 months this system has helped bring about many beneficial results. The Shops are now more equalized; departments under or over supplied with men have been reorganized so that they are in harmony with the entire plant. A better feeling prevails in all departments; men are not unexpectedly called up to work at night, their work is laid out for them each day and they see that it is done on schedule time if they wish to avoid delay marks and consequent censure. Friction between departments is reduced to a minimum. An Erecting Shop Foreman when trying to hurry some part in the Machine Shop is told to get out and come back on the day when it is due and he can have it; there is no other argument unless by special order from the General Foreman. A workman can no longer say to his foreman, "You didn't tell me you wanted this done on a certain day," because the date fixes the job and stands for the foreman's written order to the man to perform it.

This system may be used as successfully under piece work as with day work compensation. In fact the piece workers like the "system" because they now get more work and it comes in proper order; for days ahead they know about how much they can make and this regularity is gratifying. The fast workers make more money because they get more work and the slow ones earn more because the incentive of meeting the dates stimulates them beyond their normal output. In some cases it was found, under the old methods, that a man would select a high-priced job for an engine going out much later than the low-priced job at hand. The reason for this was that he might be sick or lay off the next week and the other fellow would get the high price. This condition is automatically corrected by the dating system since the work must be finished on time regardless of its price.

Another surprising benefit comes from the effect on the men of having the work laid out for them each day. The dates represent jobs and any man will work to the best advantage when he is given a specified job or task to finish within a stated time. A man who is constantly "jacked-up" by a foreman cannot do his best work and is not in the humor to do it if he wants

Showing Schedule in Blacksmith Shop N. Y. C. Ry.

to and the days of relying upon the energy and force of any one man to get results by constant driving are passed. The daily appearance of the delay sheet with another "X" added each day that the piece remains unfinished stimulates a workman more than can be estimated.

The foremen praise the system since it relieves them of unexpected censure and when the blame is placed it hits the right man and he always knows it is coming. The General Foreman's duties are now much less complex. Under the old methods he might go from one department to another trying to fix the responsibility for delays; some will tell him one thing and others another but now the daily delay sheet tells him just what is holding the engine and which department is to blame. No system can take the place of foremen but this system can take the place of endless questioning and running about, allowing the foremen to get in touch with their men and answer questions kindly and patiently. The foremen's duties now become not so much a matter of seeing personally that each man is provided with a job and that no work is delayed, but of passing upon the quality of the work and giving instructions as to the best and quickest ways of doing it. In conversation with a General Foreman in one large shop where a similar system has been in operation for several years the writer asked the question: "How does it affect your work?" The reply was: "Since this thing was put in my job is a cinch!"

During the past twelve months Mr. H. Wanamaker, Superintendent of Shops, has made several important changes in the organization at West Albany resulting in a greatly increased output and it is due to his efficient management and generous endorsement that this planning system has been credited with a portion of the success attained. Efficiency in shop operation is not obtained wholly through systematic methods but the scheduling and routing plan described in this paper, if properly installed, will identify the weaknesses and indicate the principal steps to take in building up an effective organization.

For further discussion of this work see:—
Proceedings Central Ry. Club, September, 1912.
Railway Age Gazette, September 20th, 1912.
American Engineer, October, 1912.

Mr. Gardner: In order to give more time to the discussion of the paper, which I will be very glad to hear, I will read No. 1 and the final chapter only. The intermediate pages are detail which are not pertinent to the meeting. There is one part I wish to criticize. A foreman should not come back on the day that the part is due. This part will be sent to the foreman on the day that it is due.

Mr. Logan: Wouldn't it be well to have Topic No. 3 read by Mr. Hall, which is a continuation of Mr. Gardner's paper.

Topic No. 3.

January 2, 1913.

As it is the custom in any successful plant either a locomotive or manufacturing shop to have a system to be governed by, the shop schedule is a very important factor in the operation of work of this nature. This schedule must not only deal with one part of the engine or machine, but must cover every part so that the completion of the work will not be delayed by the lack of an important item, which will necessarily hold back constant progress. As an example, in a locomotive shop, that is not equipped with a separate manufacturing department, giving an average output of 44 engines per month of which 11 engines are for thoro, 11 are for general and 22 are light, as well as 15 additional engines that are undergoing repairs for the following month, a shop schedule is of the greatest importance. In the Illinois Central, C. & N. W. and other shops the method used in arriving at the proposed figures is as follows: A meeting held in the office of General Foreman once a week. This meeting is attended by the Boiler, the Machine Side and Erecting Side Foremen. Each has the necessary information ready as to about what he can do with the force he has employed. The engines are marked down on a sheet of paper in numerical order as follows: 16 - 46 - 47 - 96 - 109. The

first engine is then called off and the Boiler Foreman asked as to when he can furnish Boiler for delivery to Machine Shop, provided boiler has been sent to Boiler Shop, if not space is marked O. K.; after this, the date boiler will be ready for pressure is obtained. The object of this is to give both the Machine and Erecting Side Foreman an idea of what date it will be necessary for them to have cab fittings and boiler studs as well as the dry pipe and other necessary fixtures mounted on the engine. After this date is set both the Machine Shop Foremen are requested to give figures showing just how much time will be necessary to complete engine for trial trip.

The information given on this sheet is then sent to the Main Office, similar information being furnished from all other points on the system from which a general itemized sheet is made up showing just how many engines are held awaiting repairs, how many engines in shop (date in and date out). This sheet is furnished all the general officers. From the first or original sheet both the Machine Shop Foremen, on the day following make up the shop schedule which roughly outlined is as follows.

Pit	Engine	Date in Shop	Boiler Over	Ready for Pressure	Wheels and boxes	Engine on Wheels	Valves set	Date on Trial

This sheet is furnished each shop foreman and gang foreman in the Locomotive Department as well as the shop and gang foreman in the Cab Department and is usually tacked up in some prominent place in each gang for the men to have access to. This relieves the Gang Foreman to some extent as all concerned understand that figures must be met or a reasonable explanation given for not doing so. In the Illinois Central there is no given time for any of the work such as fire boxes, flue sheets, light or general repairs as they do not think that a special time limit on work of this kind is successful for various reasons. That the unexpected always takes place in a railroad shop as a rule which means that men designated to these jobs are changed around to meet the conditions that arise, some on account of more work to be done than was first anticipated or some special engine or engines that must be given preference over others due to shortage of power of a certain class or a certain division.

The C. & N. W., however, and others have a time limit, which works very successfully, as follows: Light repairs, 64 hours; heavy repairs, 114 hours; general repairs, 144 hours; general and new fire box, 200 hours.

The aim of the largest percentage of the railroad shops today is, to turn out the largest output of good work in the shortest possible time. This can be done by the use of a schedule that can be altered by the shop management as the conditions require and by not being held to first figures submitted. Quite often to give any special engine preference means the loss of two or more deliveries that could have been completed had the work been allowed to go along the regular channels.

We are of the opinion that a shop schedule worked out along these lines will increase the output very materially, conditions, however, at various places will necessarily be met with and changes made to suit. One in particular is the advantage the shop that has established a manufacturing plant for finished material so that it is not necessary to rob some engines that is nearly completed to send such part to some other point.

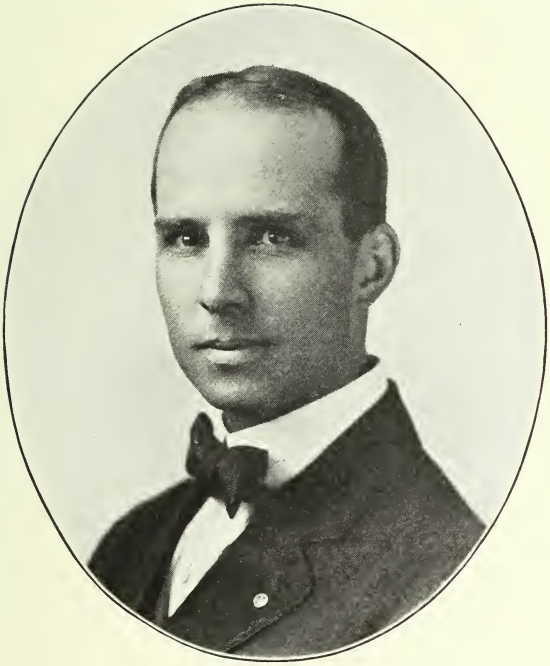
L. A. North,
Gen. Foreman Ill. Central.

Geo. C. Bingham,
Gen. Foreman C. & N. W.

Henry Gardener,
N. Y. Central.
Committee.

President Scott: That completes the paper on shop schedules. Mr. Gardner and Mr. North are ready to answer any questions you may wish to ask.

Mr. Logan: I would like to impress upon all the General Foremen the



J. S. Sheafe, Member of Executive Committee

absolute necessity of a schedule, not necessarily one as elaborate as the one set forth by Mr. Gardner, but at least the establishment of a time limit on engines. Such roads as have not used a schedule necessarily work to a disadvantage. I suggest that any foreman who hasn't a shop schedule should make a time limit, and I know the results will be gratifying.

Mr. Corbett: I haven't much to say on the subject. Where I am located we have been taking things rather haphazard, and I believe I will learn more by taking in what is said. We have a time limit, of course, to put an engine through, but I do not think it is as thorough as the gentleman just spoke of. I prefer to hear from some one better posted.

Mr. Masters: I do not know as I am in a position to give a great deal of information. We have a shop schedule in our shop and we change it twice a week, not altogether to meet the failures in getting up the shop schedule, but to meet the conditions that are coming in. How do the various railroads get the information from the various departments as regards a shop schedule? Do you issue a sheet to all the various departments, post a blackboard, or how do you get into the thing in order to get the infromation through the various departments so there will be no hitch?

Mr. North: Mr. Gardner has a more elaborate arrangement with a board, but he just spoke to me about it, if the Company does not furnish a board, that the sheet is very essential in giving information.

As Mr. Hall stated in the paper he read, it gives a clearer outline of just how the shop is handled; it gives the information to all of the departments, and there are enough sheets run from the original copy to give each gang foreman a copy, which are tacked up in prominent places so that the men from the various shops have access to them at any time. They know and are trained to follow out the schedule, and if closely followed it gives the article listed first the preference, so as not to cause any delay in the completion of the job.

President Scott: I would like to ask Mr. Wright of the Hocking Valley for some remarks.

Mr. Wright: We have a shop schedule. It is nothing elaborate as in the paper discussed. We have a meeting twice a week. One meeting is called in the Master Mechanic's office, and a report is gotten out at the end of the week, showing the engines that are due out of the shop that week and also what is for the week following, and the foremen of each department are present; each man is questioned as to where his work is and when the engine is due out. If anyone is behind it is brought to the meeting and a note made of it. Each Thursday we meet with the General Foreman and the same report that the engine is due out that week is gone over, and the General Foreman gets his idea of the work for the following week. I am interested in the report of a schedule for work. I think we could work it out very nicely in our shops.

Mr. Dickert: We have a schedule, simple in form, which works out very nicely at our shops, and I do not see how we could carry one as elaborate as this one made out on the paper, because our force is small. We have a form that is made out by the General Foreman. They have a meeting once a week of all the foremen, and once a month a joint meeting. In the car shops, and in fact all foremen go over what engines we expect to get out the following week. We also hear the complaints of the General Foreman of trouble in getting the work from the different departments. At the beginning of each week the General Foreman furnishes a list of the engines to be turned out that week and this is furnished to all departments. We find that it works out very nicely.

President Scott: I do not want to close the subject unless we have all expressed ourselves. There are many interesting points. Do not let an opportunity go by whereby you can increase your efficiency by getting up and asking a few questions. These gentlemen went to considerable trouble to get up these papers and are ready and willing to have you tear them to pieces if possible.

Mr. Logan: I would like to supplement my remarks with one idea that may be beneficial to those having charge of large shops. At the main shops

we used to make out and distribute slips among the various machinists engaged on special work. The slip contained the number and days out of all engines in the shop. They were placed where plainly seen by the foremen, and when the men on the machine finished the work on a certain engine the engine number was crossed out, or a line drawn through it. This was a great help to the foremen in the various departments in his rounds as a glance at this would tell just what work was done. The foreman did not have to stop and engage in conversation.

Mr. North: I have a system recently installed that works along the same lines spoken of by Mr. Lincke. We have some boxes placed on the side of the old tool room. The gang foreman at the end of the day's work is supposed to check over his engines and show just exactly what is delaying his work. Each department — the general foreman goes up and picks out these slips and he knows just who is behind and the gang foremen are as much alive to the situation as the General Foremen.

Mr. Cross: There are a number of systems of shop schedules and progress of work that I have been familiar with at different times; there are good ones and poor ones. This plan of Mr. Gardner I would say was a good one. It provides for the intelligent planning of the work so that the head of the plant will know in advance what to expect and can insist upon it. Another good feature about it is that it relieves the chief man of the organization from the detail work of chasing all the movements of the work through the plant. Studies of the different operations are made by competent persons; from that constants are arranged which may be made by a clerk. He can arrange these dates in a systematic manner. Any variations that he chooses to make, he can, but the general plan can be carried on systematically by one or two persons, who are not necessarily experts, but they can do it in a manner satifactory to the chief so that he can see after a few minutes' examination of the sheets each day just how things are going, and the only interference he would have to make would be to give orders in regard to preferences. I am familiar with the schedule Mr. Gardner has and I would recommend it for shop organization.

President Scott: I have always advocated strongly the scheduling of engines through the shop. At our point we haven't any elobarate system, still we look to all foremen to keep alive to the situation to see that their engines are listed up far enough in advance to get the material in order to make the progress necessary for quick operation at the least possible delay while going through the shop. The road foreman reports and the Master Mechanic gets out a 60 days' notice of the engines that are required to be shopped at a time. The foreman looks up the material needed by the locomotive in order to see that it is on hand, and if it is not in stock it is ordered immediately. When the engine arrives in the shop, our work is carried on on the specialty basis until completion. We have our shop meetings once a week, in the Master Mechanic's office, the Master Mechanic presiding. We have a crude form gotten up by a clerk which distinguishes the different operations under which an engine is necessary to go through in order to complete the work, and a slip is handed to each foreman. We have driving box, links and all scheduled, and one man puts it up to the man who is holding him back from the completion of that particular job. At these meetings these slips are all handed in to the Master Mechanic, and if the machine foreman is behind on his driving box, he has to give some reason satisfactory to the Master Mechanic why that job is delayed. And in that way we keep up a pretty fair schedule on engines going through the shop. And while the papers are on an elaborate scale, they are very complete and we can get a lot of information to add to our little home schedules.

Mr. Shepherd: I do not know that I have anything to add. We have a schedule of our own upon which we are working, not as elaborate as some which have been explained. I think I am more interested in listening to the points brought out by those who are not handling it in the same way, than I would be in endeavoring to propose any new practice. The practice of scheduling is the only one upon which we can carry on our work with any success whatever. We have different methods upon different roads. In regard to report-

ing to the shop foreman ahead when the engines are due, ours are handled on the percentage basis, and the reports pass through all the foremen's hands, and the formen prepare for their work on the percentage lines. In other words when the report turned in shows an engine at 15 or 20 per cent, we know about how many days before we can look for them to be turned over to us. I do not think there is anything more I can say on this line. We have had some very interesting papers along that line, well worthy our time and the Company's time that has allowed us to come here and hear these things brought out.

Mr. Christy: Each foreman each morning about 8 o'clock makes out a report of every engine that is in the shop every twenty-four hours. If an engine is in for slight repairs this report is handed around each morning at 8 o'clock.

Mr. Reyer: I do not know as I can add anything to what has been said. We have a system which is not as elaborate, but it serves our purpose. We have to break in on the schedule on account of other engines being given precedence, but I would recommend a schedule.

Mr. Hobbs: There is not very much I can tell you only from a small shop basis. We have a small shop and with the various classes of work to contend with it is pretty hard to work out any kind of a schedule. We have to take work as it comes and do the best we can with it. There are lots of times that the regular back shop work has to lay down and the motor cars and steamboat work is given preference. I am very much interested in the schedules that have been brought up here, and shall endeavor to do as much along that line that I can, although the conditions under which I work are probably somewhat different than what the majority are working under. Some of you have larger shops, but I know you haven't all any McKees motor cars.

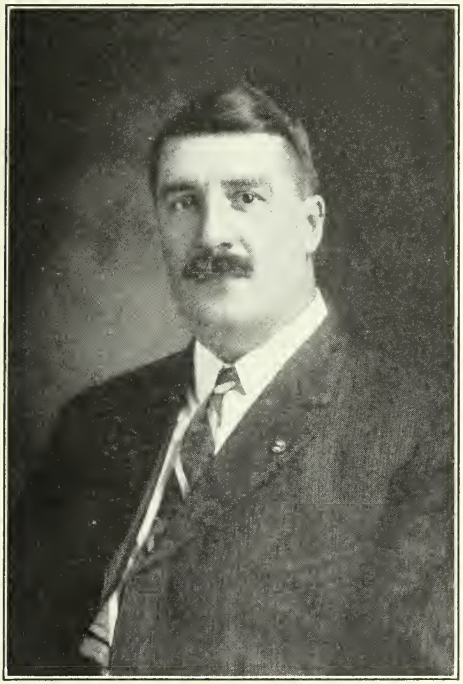
Mr. Hodges: In our shop we form a schedule of engines and when they come in the shop I figure when they should go out, and I pass that all through the shop. I tell them when I want a preference, and we rush them right through. And the back shop engines, we figure on as near a date as we can when we can get them out.

Mr. Newman: I do not know as I can give you any information any more than has already been brought out. We have a shop schedule of course of the dating out of the engines, which is readjusted once a week. We have a foreman going through on Friday readjusting the engines for the following week and the next week. We try to keep two weeks' output ahead of us all the time. I am a firm believer in shop schedules also in the daily schedule. I think that is absolutely necessary. We do not handle it by the card system, but we do by getting together. I think that in a large shop where it could be handled, like on the New York Central, it would be quite an advantage. Our people have gone into it but they haven't put it into practice.

Mr. Dickert: There is no necessity for a foreman to go about the work. We handle that by messengers who deliver the work from one department to another. We have each department deliver the work to the department where it belongs.

Voice: We are using a schedule 30 days in and 30 days out. It is a small shop. I do not think I can add anything, and am here to receive instruction.

Mr. Gardner: This schedule looks technical to look at it, but it is very simple. The great trouble we found is that the average man is afraid of it. There is too much so-called technical material there to give the time to study it out. We take an engine and give it a certain number of days, say 18. You can only build an engine one way. You cannot put the lug on before you build the air pump, but there are certain routine things in building an engine that have to hold in all cases. The first thing to decide is what parts of your engine goes in; then you begin to give your dates for these different parts that you wish done in building that engine. The dates may overlap each other and you have to keep up. It is a cut and try proposition till you get what you want for the 18 or 24 hours schedule. These constants are not derived by stop watches. It is a practical demonstration of how much time



GEO. H. LOGAN, Member Executive Committee

it takes to build an engine. I am going to put this system in the shop at Avis by orders of the Superintendent. I am going to take a special apprentice and put the full system in and running in ten days. That is ample time. So you can get some idea how simple it is if you take the time to go into it and study it out in detail. You will find 276 dates given for every engine. Our General Foreman carries a slide rule on his desk and they can be put down in 18 minutes. One engine is posted for 75 items on the dispatch board; the items for that engine include 276 dates, and they can be put on that board with a little stamp in 8 minutes by an apprentice boy.

It is not necessary to have a special clerk or a high grade man for this work, after an ordinary man has been around for a week or ten days, he will understand it. We had foremen's meetings as you all have until the system was put in at Altoona and then one general foreman gave it up after another. We keep the meetings for general discussion and appoint committees in order to determine how to improve the shops in a general way, but we make no mention of the dispatching of engines. I recommend that all foremen's meetings be abolished as unnecessary.

Question—Do you ever readjust the schedule after it is made out?

Answer—Very frequently the schedules have to be adjusted after making them out. It is not possible to make schedules for any shop the first time trying. You will very soon find as we did that we could not give quite so many days for one thing, and the smith shop could not possibly deliver in such a time, and we squeeze a little on one fellow and give the other more time. I have here a copy of a little note that I forgot to read taken from a paper read by Mr. Kendall before the Canadian Railway Club. He wrote a splendid paper describing the system. The system was introduced by H. L. Gent, one of the experts on high grade work.

"Existing conditions being the sole governor of the output, the schedules may be altered without hesitation to meet the requirements from time to time as occasion arises, and engines are set back or forward in accordance with their individual importance, so that at no time is the schedule allowed to throttle the output, or delay any individual engine which may be especially marked. The real object in view is to arrange the schedule to supply whatever the requirement may demand and at the same time give uniform and constant output."

We cannot make as rigid schedule in the repair shop as we can in the builder's shop, and engines are backed up or pushed ahead as consistent with special requirements, but the cost is more than the gain to the Company by getting the engine a few days sooner.

Mr. North: How do you overlook the proposition of the men laying off. In a shop of 550 men oftentimes we have 60 to 70 men off per day.

Mr. Gardner: Men laying off is perhaps the greatest enemy to any shop schedule. In West Albany, or on our Division, that is controlled to a certain extent by the flexibility of the schedule. We give plenty of time. We give 18 days for an engine when we feel that we could get it in 16 or 17. That probably is the only way we can take care of men laying off.

President Scott: We thank Mr. Gardner very heartily for the able manner in which he has handled the subject, and the discussion will now be closed. Before we adjourn I would like to announce that we are expected to be at the Northwestern depot for a visit to their shops at 3 p. m.

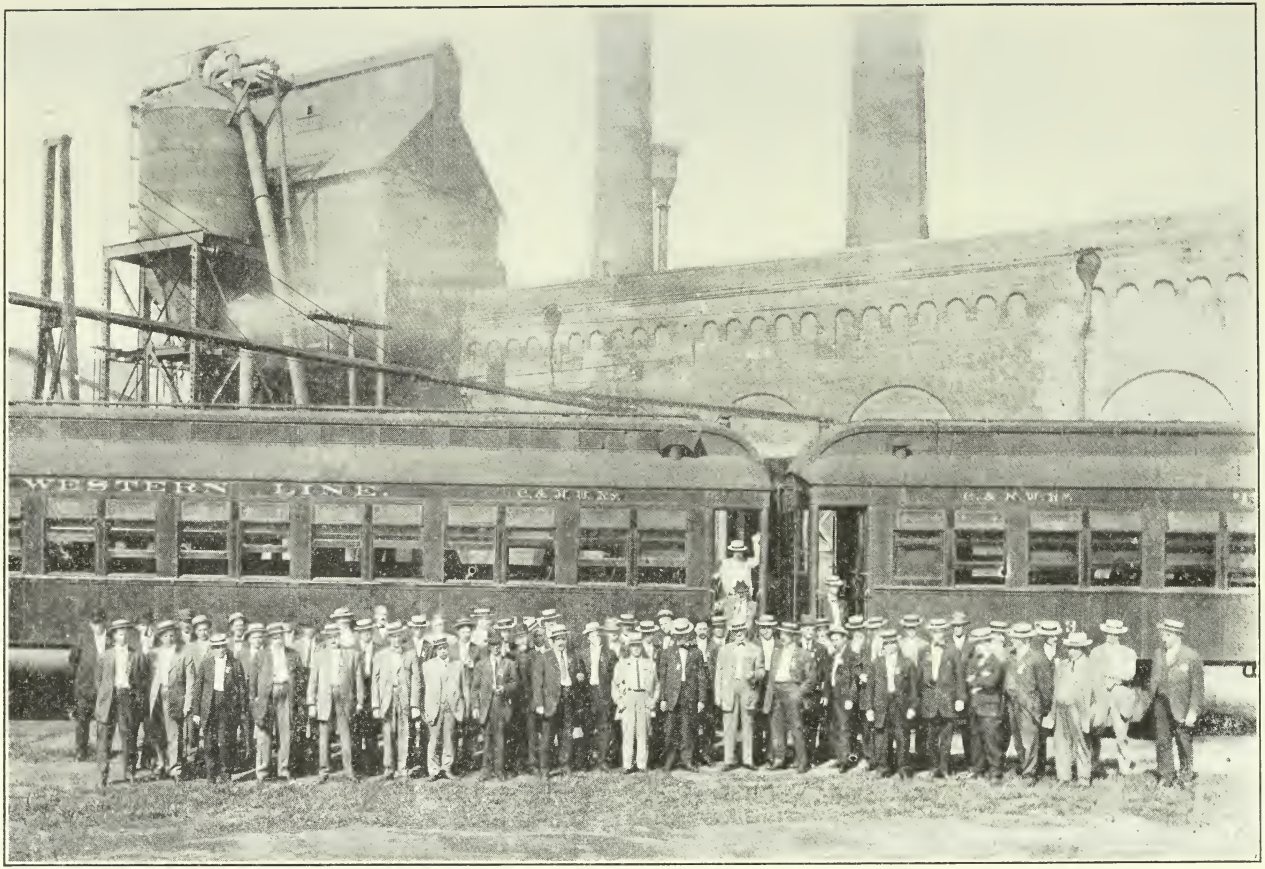
FRIDAY'S SESSION

President Scott opened the meeting at 9:45 and introduced Charles F. Hatfield, field secretary for the Panama-Pacific Exposition, who extended a cordial invitation to the Association to hold their 1915 convention at San Francisco.

Mr. Logan took up the subject of driving box work.

Topic No. 4. Driving Boxes.

The driving box and its component parts, viz., — binders or pedestal braces, shoes and wedges, form one of the most essential parts of a locomotive and when properly machined, assembled and taken care of, give the engine



General Foremen visiting C. & N. W. Railway Shops, Chicago

The secretary wishes to take this opportunity of thanking the friends of the International Railway General Foremen's Association, through whose generosity the publication of this book was made possible.

Members are urged to get acquainted with them through their advertisements.

crew and round house foreman but little trouble and prolongs the period in which engine may be kept in service between shoppings, to a most considerable extent.

The combination mentioned is valuless, however, if any of the three stipulated conditions — 1st, proper machining, 2nd, proper assembling, and 3rd, proper care — are not carried out as trouble will follow. Carelessness in machining makes proper assembling impossible and proper care superfluous if machining errors are not corrected. Proper assembling and machining are worthless if proper care is not taken as a pound will soon develop. If wedges are not properly set up and if engine is allowed to make a few trips with loose main wedges, due to carelessness or indifference of crew on engine — failing to report same — or if reported, work not done by round house forces, for any reason, the setting up of these wedges will not eliminate the pound, and particularly is this true of a left main box on a right lead engine, or vice versa. The pound is still there — the box does not pound in the jaws but the journal pounds in the brass and unless wheels are dropped and the brass rebored or renewed, you by continuing engine in service invite any or all of the following troubles: — the breaking of frames, rods, rod straps, crank pins, crosshead keys, pedestal, binder, frame, deck and cylinder bolts — excessive wear on rod bushings and brasses, the loosening of wrist pin bearing in crosshead, crosshead and spider fit on piston rod, and if a Stephenson motion, distortion of valve gear. In fact, we do not believe any one can estimate the resultant damage of a main driving box pound, with any degree of accuracy, as many of the breakages and defects mentioned above do not occur or become evident until after the pound has been eliminated by proper repairs being made and engine again in service, but were nevertheless due to lamination of metal or the starting of indiscernible cracks incurred while under stress of pound in question.

The importance of keeping binders tight in frame, jaws and wedges set up so as to preclude possibility of any other than intended vertical movement cannot be too greatly emphasized.

Special attention should be given left main driving boxes on right lead road engines as this box is subjected to harsher shock from piston thrust than the right one, as, when engine is working in forward motion and steam is admitted to left front cylinder port, left main driving box is against front of jaw and a very little clearance between wedge face and box means a pound at this point. This condition also exists when steam is admitted to left back cylinder port as at this time box will be found forced against back of jaw and must move ahead to front of jaw when steam is admitted to back of cylinder.

To make this point particularly clear, let us assume wedge to be at back of jaw and shoe to the front on a right lead engine working in forward motion, and we find that these conditions exist at time of steam admission to front of left cylinder, left main driving box is against shoe. At time of steam admission to front of right cylinder, right main driving box is against wedge. At time of steam admission to back of left cylinder, left main box is against wedge. At time of steam admission to back of right cylinder, right main box is against shoe. It is now apparent that right box is in logical position to receive shock of piston thrust while the left must be forced from shoe to wedge and wedge to shoe, each revolution while engine is working steam.

This accounts largely for excessive worn flat spot on left main tires due to slight slip of wheel necessary to change position of box from shoe to wedge or vice versa. Slip will also be perceptible if brass is slightly larger than journal. While the C. & N. W. Ry. have no left lead engines on our system we will guarantee that where they are in use, right main box pound is as much a source of trouble as the left on other systems. Without any authentic information on the subject we will also venture to say that when a wheel lathe man starts to turn the first pair of tires of a set removed from a left lead engine he will place the main tires in his lathe first and determine the diameter to which set of tires will be turned, by truing up the right main tire, providing tires have been removed on account of tread wear.

Driving box troubles are more frequent on engines having underhung springs than those with springs on top of frames, not because the difference

in suspension causes excess wear or strain, but because the wedges and wedge bolts of an underhung spring engine are neglected in service. Where one of two wedge bolts is broken a block is substituted. Let us be honest. Haven't you all seen both wedge bolts in one wedge broken and a wooden block serve the purpose? Haven't you seen wedges set up until the top of wedge is in contact with frame and further adjustment impossible? Haven't you allowed engines to run with flange broken off a shoe and wedge, or both? And haven't you told the engineer in charge of these engines that you would fix him up next trip in and then didn't do it because you had no relief engine and knew that if you undertook the job it would delay a train out of your terminal or that if you assigned enough men to make repairs in time, other necessary work would be neglected?

We would greatly appreciate an answer to our questions by all members present who have been guilty at any time in their official career of any or all of the charges preferred in our questions.

Conceding that some few of us have allowed these conditions to exist because of the difficulty and time involved in making necessary repairs, have we been fair to the Company that employs us? We do not think so; we may gain the good will of the Chief Train Dispatcher or Division Superintendent, temporarily, by having engines available on short order, but there is a day of reckoning coming for all who permit these defects to exist any length of time and when delay to some important train, through failure of engine on which necessary work has been neglected, occurs and Superintendent reads failure report, if the investigation as to cause has been thorough, his opinion of you will change and he may even ask "What discipline was administered to responsible party?"

When these defects are discovered, if necessary, arrange for a relief engine, but make repairs promptly, and while spring rigging is down, make careful inspection of all shoes, wedges and bolts that no defect may be overlooked which might make it necessary to hold engine again for repairs which should have been made at this time.

The correct adjustment of wedges is an important factor; on the road the average engineer takes advantage of time at a meeting point or a stop of a few minutes for any reason and spotting his engine with right crank pin slightly in advance of top quarter, he loosens nuts on wedge to be adjusted, gives engine enough steam to pull drivers against front jaws, or if brakes back of drivers, sets his drivers, and pries up wedge with small bar, then tightens wedge nuts and if parts are properly machined he has set wedges up under ideal conditions, and it should give him no further trouble.

We say ideal conditions for this reason:—Engine has been working and all parts have warmed up to normal maximum temperature which assures a normal expansion of parts which is very desirable in adjusting wedges properly so when an engineer reaches a terminal with wedges reported as needing setting up, same should be done as soon as possible in order to obtain the benefit of conditions mentioned.

The C. & N. W. Ry. uses Elvin Lubricating grease cellars on all large power and it has given very good service, though like all good things, good because they serve their purpose and require little attention, they sometimes do not receive this little attention and a piece of perforated sheet steel does not make a good lubricant for a driving journal. We know this absolutely by reason of our having made several unrecorded tests.

If you use Elvin grease cellars, we presume in your roundhouses you have made it the duty of some one man to inspect these cellars. If not, do so and it will save you considerable trouble.

In speaking well of anything used on a locomotive it is always well to modify your statement because there may be some objectionable feature that has not attracted your attention, but is apparent to some one else and may become very evident to one who on the strength of your recommendation equips his engine with parts or device in question.

We have considerable loose driving brass trouble on large power, where brasses are pressed in boxes. (The distinction is made because of the Markel

removable brass of which we have a large number in service and which can be tightened by means of taper key) and while I may be alone in my contention, I am going to contribute considerable of our trouble along this line to the Elvin grease cellar. I believe that the constant contraction and expansion of brass in box due to heat generated by use of Elvin grease destroys what little elasticity remains in brass after being pressed in box and makes for loose brasses, particularly so when cellars are not given the proper attention, and axle heat is greater than when cellar contains sufficient grease and springs are performing their intended purpose. A cellar may be well packed, but if plate is cramped in box and springs cannot force it up, cellar might as well be empty and I am sure you will find it pays to have the engine inspector's eyes and not the engineer's or fireman's nose, discover a defect in this cellar.

The lateral wear on driving box faces is one of the troubles we presume you all are familiar with and wish you could eliminate, as with the great majority of boxes now in use, it means the dropping of wheels in order to take up lateral motion.

We use babbitt-metal on hub side of our driving boxes and in addition to dovetail recess use a number of brass plugs which are cast a trifle full of $\frac{7}{8}''$ diam., are $1\frac{5}{8}''$ long with 3 grooves $\frac{1}{8}''$ wide and about $\frac{3}{32}$ deep at one end. These plugs are driven in box and serve a double purpose: First to help hold babbitt to face, and second: Plugs are spaced so that in case babbitt breaks and loses off, plugs cover wearing surface on driving wheel hub and keep box itself from hub temporarily, and as most of our boxes are cast steel, keeps hubs from being cut for some time. In addition to the brass plugs on the hub face of our boxes, we have woven copper wire criss-cross around these plugs and have found it very helpful on our Division in retaining babbitt and experience less trouble from sections of plate breaking and dropping from box.

We have a large number of our engines equipped with the Markel removable hub plates, a very ingenious device which makes lateral troubles on these engines a matter of small import as it is possible on these boxes to remove plates and substitute plate kept in stock in the remarkably short time of $1\frac{1}{2}$ hours per box, or working two men on the same pair of wheels, $1\frac{1}{2}$ hours to take up lateral in a pair of drivers.

As very few of you have the Markel box in use at present and for the present are interested mostly in the ordinary type of box, I will discuss the Markel box and its desirable features later.

Another source of trouble we experience is the breaking of shoe and wedge flanges on some classes of our power. Of course there is a logical reason for this and in the majority of cases it will be found that the driving box is of insufficient width and does not have flange bearing enough on frame jaws and thrust of box tends to force shoe and wedge through jaw naturally breaking off flanges.

Our Road is making what we call the flangeless shoe and wedge installation on all of its modern power, and on engines so equipped broken flange trouble is a thing of the past as there are no flanges to break. This installation, however, is not faultless as it transfers wear from shoe and wedge flanges to the driving box flange and will decrease its life to some extent while on the other hand, plates applied to sides of frame jaws will prevent any possible frame wear at this point, and is, therefore, a point in favor of flangeless shoes and wedges. If you have broken flange trouble from cause assigned, insufficient box flange bearing, you can overcome or reduce breakages to a minimum by the use of a generous fillet in your shoes and wedges and by planing the side surface of both shoe and wedge on hub side 3-64ths lower on part that extends beyond jaw faces, this takes all tortion from box thrust and overcomes tendency to force box through jaw as impact is entirely on flange which in turn is forced fairly against side of jaw. I beg those of you, however, who are contemplating a change in driving box patterns to make sure of sufficient flange bearing. And as a suggestion, why not make at least the outer wedge flange of your new driving box the same taper as your wedge and be insured of a full jaw bearing, if your jaw taper is the same as ours $\frac{1}{16}''$ to the foot it means something in a box 18 or 20 inches long.

Primarily, we believe flanges on cast iron boxes were shortened to lessen broken driving box flanges. Very good — it helped to some extent but some of you overlooked a bet when you changed from cast iron to cast steel and neglected to change width of box, even though the material you intended using practically precluded the possibility of flange fracture.

We presume most of you use cast steel driving boxes. If you don't you can't realize the comfort we who do take in them. If correctly designed and provisions made for bronze, not brass, liners on shoe and wedge faces, they are practically indestructible and should last a life time.

I am on record on the Chicago & North Western as being opposed to liners on driving boxes at shoe and wedge face. I am when liners in consideration are of cast brass $\frac{3}{8}''$ thick, held by 5 rivets, but I would endorse a bronze liner of sufficient hardness, securely fastened to faces of box. With suitable liners, a cast steel box after once being machined, needs only to have its several removable parts, viz. — brass, hub plates and liners of babbitt, brass or bronze preferably, renewed to last indefinitely and maintain its original dimensions.

Original dimensions bring to mind the fact that in planning shoe and wedge faces in repairing driving boxes, a cut is also taken off flanges to facilitate machining as, after one face is machined, a cut off flanges at same time permits planer hand to turn boxes over, clamp and machine, as no setting up is necessary. It would not be necessary, anyway had he set his boxes up on parallel strips which would engage the shoe and wedge faces and not rest boxes on flanges. It is true that boxes would have to be clamped a little tighter on account of a narrower base, but after boxes are firmly clamped, wedges can be inserted under flanges in a minute or two and will serve the purpose fully as well, and you will save your flanges. Remember! narrow flanges mean broken shoe and wedge flanges.

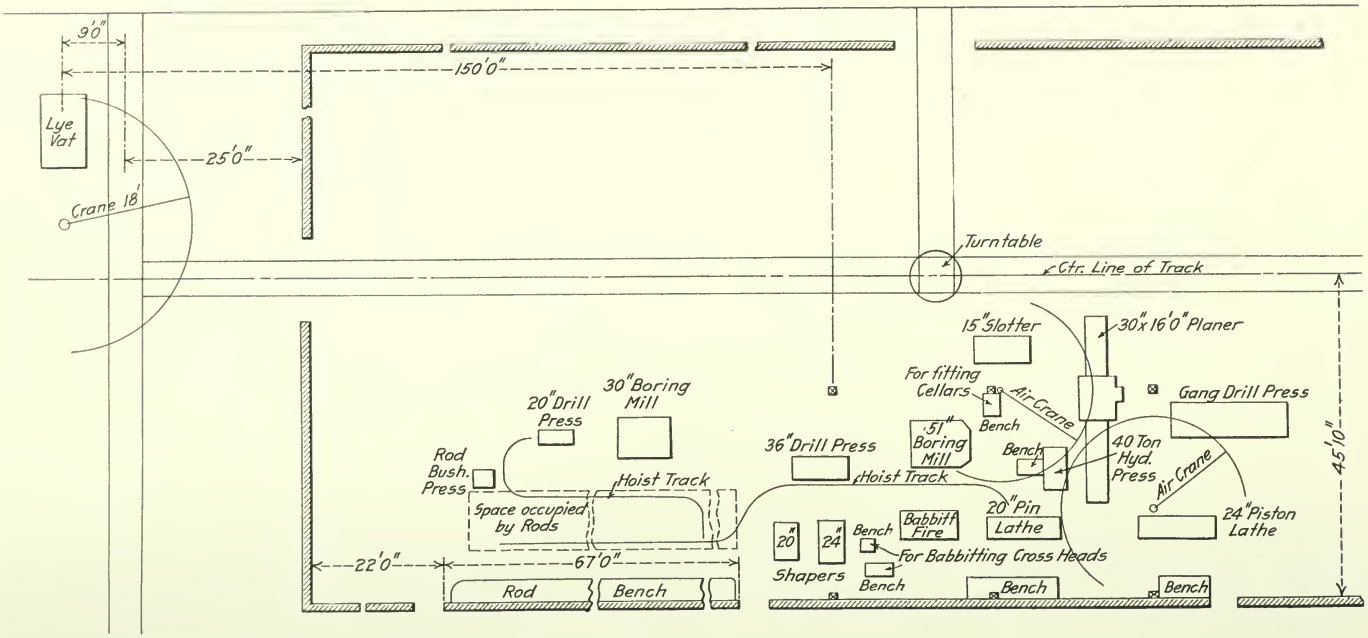
Driving boxes finished, except for boring of journal and facing of hub side, shoes and wedges finished, except face, should be carried in Storehouse stock.

This practice is followed on the North Western and though located 470 miles West of Chicago Shops, by wiring for material of this kind prior to 10:00 o'clock A. M. same is received by passenger train at 2:15 P. M. the following day. This refers of course, to small quantities and urgent need of engine for which material is needed, as ordinarily material is shipped by freight through request on regular requisition.

Boxes for stock on our Road are usually machined in lots of 12; they are first placed on double head planer and sides surfaced. Next are delivered to large slotter and slotted two or three at a time, for brass and cellar fit. From slotter they go to hydraulic press, close to which is located lathe where brasses are turned to fit boxes. As soon as brass is turned it is placed on box and end bearing marked by gauge, taken to shaper, shaped, pressed in box by hydraulic press at pressure ranging from ten tons on small cast iron boxes to twenty tons on large cast steel boxes. Boxes are then taken to double head planer, are clamped six to each side of form or parallel block and planed. In planing insides of flanges double tool is used. From planer, boxes are taken to four spindle drill press and drilled for oil retaining plug and cellar bolt holes. This finished, boxes are coated with Anti-rust compound and placed in Storehouse stock. The draw cut shaper is being given preference by most railroads in machining boxes for brass fit and is also used extensively in machining brass for box fit. I prefer a lathe in spite of another handling at shaper for this reason.

Most of our boxes are chamber cored or recessed for babbitt, averaging a depth of about $\frac{3}{8}''$, boxes being so designed that babbitt sets out beyond box face at least $\frac{1}{8}''$. This leaves at least $\frac{1}{2}''$ of brass not necessary to turn in fitting brass, and we do not turn it but instead, turn up to it face off square and we then have a shoulder averaging $\frac{3}{16}''$ to press against face of box and it is a big factor in the maintenance of tight brasses.

A special chuck or arbor is used at Chicago Shops designed by E. J. Brewster, General Foreman, which will hold brasses for any of our various



Driving Box Layout, C. & N. W. Ry., Winona, Minn.

classes of engines, by the turning of six lugs fitted in square holes, three to the end. These lugs are square shanked and have knurled or checked faces which engage ends of brass. Faces are cleptic and center radius changes by quarter turn of lugs. Arbor is so devised that after one pattern of brass has been set for turning, no adjustment is necessary in setting other brasses of same pattern. Arbor is rigid and practically free from vibration under stress of heavy cut.

The machining of shoes and wedges for stock can be done most economically on slab milling machine and all surfaces except face can be machined at one operation. Personally, I would prefer two operations for three reasons: 1st: More simple and less expensive cutters. 2nd: Less liability of sprung and distorted flanges. 3rd: Ability to clamp more firmly, permitting of a proportionate feed increase. If no slab mill available, suitable chuck or double head planer with double tool cutters is next choice and with planer bed loaded with from 24 to 36 shoes or wedges, very fair time is made.

Considering repairs to driving boxes and accessories on engines through shop, immediately wheels are removed from engine, boxes should be removed from journals or more properly speaking, from cellars, as, if cellars are of correct design and have been fitted properly, their removal is what eats up the time as invariably they are tight in boxes.

The most common method of removal is a device consisting of one flatter, two men and one sledge hammer. A simpler and more destructive device, also commonly used, — one man and one sledge.

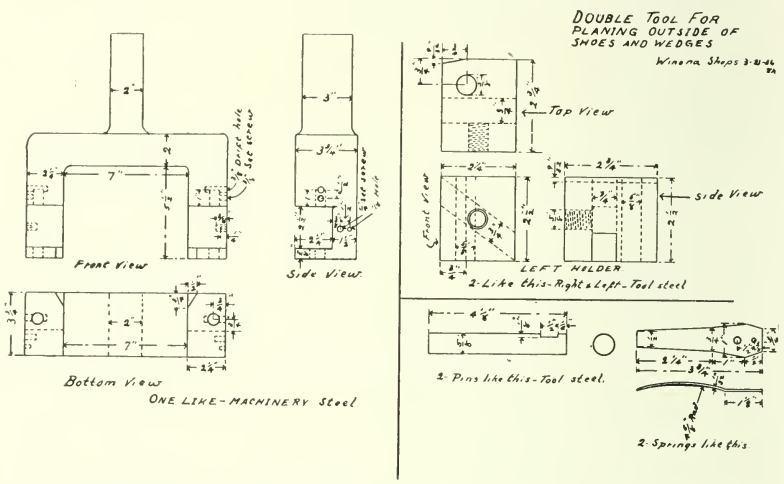
There are also a number of devices for springing boxes apart, many of them, merit worthy. For extreme simplicity would suggest a bar clamped in a vertical position to axle center, this bar to be drilled with a series of holes to cover variance in wheel centers, a cross-bar with jaw at one end to engage vertical bar long enough to pass through wheel spokes, a U shaped forging of sufficient depth and width to care for largest cellar and a short ratchet jack. This arrangement will force cellar from any box in a moment or two. After boxes are removed they should be cleaned at once, preferably in lye or caustic soda vat and then be delivered to driving box gang.

A shop of any considerable size should have machine tools grouped for this work with suitable cranes or air hoists to make moves for different operations in as short a space of time as possible. If babbitt used for hub faces, turners bench and fires, preferably gas, should be close to boring mill.

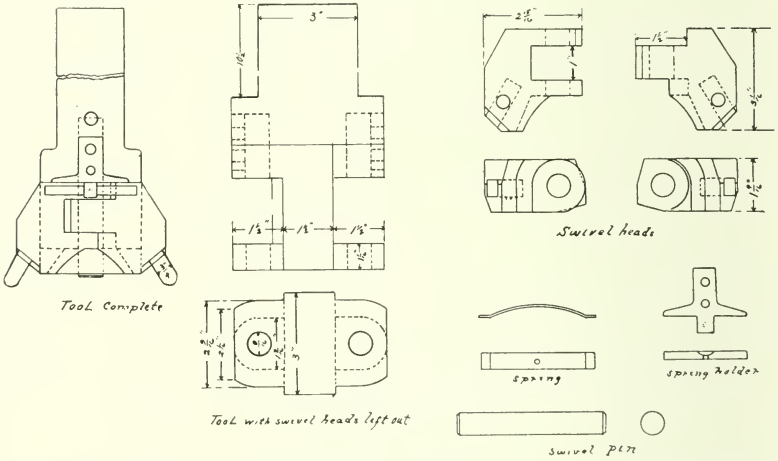
In this connection will say that at the Winona shops of the Chicago & North Western Railroad, they have an ideal lay-out for driving box work, etc. This was planned and carried out under the supervision of Mr. Chas. Coleman, Master Mechanic at that point. The plan is shown in detail in the sketch. The principal item taken into consideration in locating these machines, in addition to having them convenient for the work, was to eliminate all the trucking of parts possible, and the experience of ten years demonstration, proves that the objects sought for has been very fully attained, and from the time a driving box, piston, crosshead, or rod arrives for repairs, it is never placed on a truck or any other conveyance, unless it is necessary to send it to the blacksmith shop or it needs some unusual repairs.

The movements of these different parts, sent here for repairs are as follows:

1st. Driving boxes, if old, when taken off wheels, are loaded on dumpy and taken to lye vat, returning by way of transfer table engine hoist track, and track in center of shop, and placed along side of planer near slotter, from which point they are handled by crane; first to hydraulic press, to have brass removed; second to planer; third to babbitt fire and are then (if old) picked up with hoist on runway and drilled on 36″ drill press. If boxes are new, they are removed from planer with crane attached to wall and drilled on gang drill press, and then placed for babbitting by use of the two cranes. After babbiting the boxes are bored, the saddles and cellars are fitted and are ready to be taken to the wheels for fitting on axles. Groove is turned in outside of brass for shoulder after which brass is slotted on outside for box fit ready for pressing in, special tools for calipering being used.



Special tools are used for planing driving boxes and shoes and wedges and four surfaces are planed at one time, except on wedge and jaw face, when two only are planed.



Lathes for fitting crosshead pins and turning pistons and rods are located closely together near babbiting machines, so no trucking is necessary. All crossheads are babbited on machines and no planing is necessary.

Shapers are located handy to rod benches and brasses can be planed and babbited without trucking, and when ready to have bushings pressed in, they are lifted by air hoist on runway and pressed in on air press and taken to 20" press for drilling, and the job is completed and they can be returned to horses till wanted or removed to engine.

Brasses should be pressed out at once and new brasses fit and pressed in. Prior to this, cellars have been examined, defective ones scraped and new ones ordered and they are now fitted to boxes, care being taken that box is not spread in so doing. I believe time is well spent in close and substantial fitting of cellars, babbiting being in common use, to build out loose fitting cellars and the practice is radically wrong.

Cellars should be of heavy cross section capable of withstanding the closing tendency of boxes, thus maintaining parallel shoe and wedge faces. In fitting cellar for instance $\frac{1}{32}$ loose, I would shape a strip off bottom side a scant $\frac{1}{32}$ deep and at least 2 inches wide and rivet on a strip of $\frac{1}{16}''$ iron and a few strokes of a square file would insure a fair and lasting fit, babbitt above if you wish. Boxes now move to planer, size having been previously determined by shoe and wedge man, boxes marked with size or given to man on planer. These sizes can be taken and if necessary allowance made for planing all boxes central with brass fit with the least possible reduction, before old brasses are removed from planer to drill press, all holes drilled, liners fitted or retaining plugs drove in hub face. If the latter, boxes are now babbitted and are ready for boring.

A 51″ boring mill fitted with a special chuck, jaws of which engage planed shoe and wedge faces and clamp box centrally on mill is a splendid tool for this work. Before fastening chuck jaws, however, box is calipered and small jack inserted at cellar fit to prevent box from closing while being bored and faced. Brass should be bored so center is at least $\frac{1}{8}''$ above ends and made a neat fit for journal. Main boxes should have absolutely no rock when fit to bearing to obtain best results, nor do I see the necessity of cutting away brass at back of bore the entire length, as recommended by grease lubricating people. Certainly the grooves we cut in brass should insure sufficient grease contact surface without further mutilation or reduction of the brass bearing.

Grease grooves are cast in C. & N. W. brasses and is a time saving stunt.

Brasses are now at wheels, saddle pockets have been taken care of, wheels and journals have been repaired or renewed. The following rules govern wheel and journal repairs. Axles are renewed when cracked, loose, sprung, or any more than $\frac{3}{8}''$ smaller than original size. Journals are turned if tapered any in excess of $\frac{1}{32}$, run out of center in excess of $\frac{1}{32}$, cut, rough or uneven, or if gauge shoes them 1-128th out of round. Wheel hubs lined when worn in excess of $\frac{3}{8}''$.

Suitable crane or air hoist should be installed at space allotted for wheels to handle boxes, two small, or preferably, two adjustable horses, — a plank, a roller or piece of pipe and a small bar are necessary adjuncts.

The one point I wish to bring out strongly at this time is that in fitting box to journals, of main wheels in particular, insist upon box being parallel, most of them close after boring, and machinists if not thoroughly instructed, will pay no attention to this condition but will chip and file to a bearing and when cellar is applied, if properly fitted, we have a crown bearing only — the pound will soon follow.

Shoes, wedges and binders, after wheels are out from under engine frames, should be cleaned at once and if you are looking for trouble paint corners of jaws and frames lightly with a mixture of zinc-oxide and turpentine. This will dry in a few moments and if no cracks discernible, jar frame with sledge, — oil will ooze from a very minute crack. If none found, shoes, wedges and binders are examined, defective ones scraped and new ones ordered to replace them.

If binders on engine are of wrought iron fitted over bottom of frame jaws and bolted to frame, these are marked for closing and sent to blacksmith shop where repairs should be quickly made, as delay is occasioned in laying out shoes and wedges with this type of binder not experienced with thimble or wedge binder.

Frame jaws are now faced and this work should be well done. It is not necessary to spot face of jaws to a face plate and then grind to make steam tight joint, but we should insist upon a general bearing and consider the time well spent in making it. The "good enough" habit which has become so prevalent among railroad shops, has made many an engine a shop candidate while undergoing repairs.

Good judgment should be used in dealing with essentials and certainly driving boxes and parts are vitally essential and repairs should be thoroughly made.

Frame jaws being faced, binders are now fit and judging from the number of sway or hump backed frames I see, little attention is paid to how they are fit.

Top of frames should be level over jaws, which will indicate jaws correctly aligned, — if humped, jaws pulled together, — if swayed or depressed, jaws spread apart. The symptoms are so apparent that it is easy to diagnose the disease and apply the remedy. Insist upon frames being level, it only takes a few moments to check with straight edge and you may keep a frame from fracture by so doing.

The thimble binder, fastened by bolt through it and lower end of frame jaws, gives good service if kept tight. However, this type of binder on most engines has this objectionable feature, — hole is located so close to lower rail of frames that the nuts on bolts are almost universally tightened in the same manner, viz., with a handle set and sledge hammer. Future frame design should permit of sufficient clearance to permit the use of a wrench in tightening these nuts. Where clearance permits, a box wrench with short handle, designed for use with sledge, is very efficient.

The most rigid, and to my mind the most satisfactory binder is the one that slips up over and between frame jaws, held in place by one bolt through side of each leg of jaw and tightened by means of two wedge blocks with screwed ends. When binders have been fitted, centers must be located, preferably on main jaws.

These centers must be located so that wheel bearings are at right angles with piston travel or cylinder bore.

Centers may be located in a number of ways. Personally, I prefer lines through cylinders and a special tie square used across frames between jaw. Line serves a double purpose. If correctly set, assures centers being at right angles to cylinder bore and gives an opportunity to check frames which are oftentimes found out of alignment.

The next best method and probably the one most commonly used is to use fish tail, train from a point directly back of cylinders, midway between frames, or joint itself at cylinder bolting flanges. Centers being found at main jaws, top and bottom should now be transferred to remaining jaws by means of tram points.

Wheel center should always be kept standard, permitting the use of a gauge, prick punched and stamped, for various lengths, which trams may be set to and used by both rod and shoe and wedge men.

A piece of $\frac{3}{4}''$ octagon steel of desired length held in brackets to prevent deflection, makes a splendid gauge and can be plainly stamped. Shoes and wedges are now placed in jaws and forced apart by spreaders. If two new shoes and two new wedges were required, put them in the main jaws, if possible, and in fitting these, make sure shoe fits against face of jaw and has no vertical movement. A little red lead or lamp black on face of jaws will assure you shoe is bedded properly and does not bind in fillet at top. Determine thickness of liners necessary on old shoes and wedges and apply with $\frac{1}{4}''$ rivets. Holes should have deep and narrow countersunk for heads and would recommend no liner be used less than $\frac{3}{16}''$ thick.

Rivet holes should be drilled on sensitive drill press to jigs standard over entire road and if this is done, a large saving would be effected as liners in excess of $\frac{3}{16}''$ could be used indefinitely.

After liners are riveted in by driving center rivets first and working both ways to minimize buckling, they should be skinned or surfaced. It only takes a few moments (and you can't line a wedge down on a road engine in a few minutes.)

Shoes and wedges with LINERS FACED now back in jaws ready to lay off to box size, assuming there are three jaws and boxes of one size.

There are innumerable methods of procedure. I prefer this method: — Clamp a straight edge vertically $1''$ back of top and bottom center, both sides. For accuracy set a pair of morphodites at $1''$ and caliper from center to straight edge. Now, using an adjustable gauge set at $\frac{1}{2}$ the box size, plus $1\frac{1}{2}''$, hold against straight edge and scribe light lines, top and bottom of shoes. Now

C. N. Newman, Member of Executive Committee

determine point which will be suitable for long trams, top and bottom and scribe lines parallel with top of frames, top and bottom, on all outside faces and bottom on inside. Set small tram points 1″ greater than width of box, prick punch line intersections on shoes and from these points scribe and prick punch wedge points. Now place a straight edge through jaws and against vertical straight edges on a line with bottom points, set morphodites from bottom shoe point to face of straight edge, scribe face of shoe, prick and check. Now use small tram to wedge. From these points, back and front points are found with long tram set to gauge, and shoe and wedges sent to small quick return planer or shaper, set in chuck and surfaced $\frac{1}{2}$″ above mark shown. Fine lines and small points very necessary and to insure planer or shaper hand finding points, stamp circle around them, a $\frac{1}{2}$″ or $\frac{5}{8}$″ set screw with cupped point will answer this purpose nicely.

Shoes and wedges should be planed and put back in jaws for checking, preferably before engine is wheeled. They should also be laid in boxes to insure clearance at fillet. Filleting tools for shoes, wedges and boxes should be ground to gauge and radius made a trifle larger for shoe and wedge tool.

Make sure of your main jaws, have shoes, wedges and boxes parallel, liners and jaw faces surfaced, brasses fit to preclude rock on journal, good lubrication, keep wedges set up, binders tight, and impress upon your engineers the importance of wedges being kept up, (the left main on right lead engines in particular). Be a crank on this subject if necessary for it means decreased cost of maintenance and more efficient engine service.

The Markel driving box designed and patented by Chas. Markel, Machine Shop Foreman at Clinton, Iowa, embodies features which must appeal to every one interested in locomotive design and upkeep.

The removable brass feature, permitting the renewal of same without the usual dropping of wheels has proved to be a big time saver. At Clinton a front brass on Atlantic Type engine is removed and new one applied in three hours — main brass on same type engine with Stephenson motion, necessitating the moving of eccentrics, is removed and renewed in from five to six hours. With Walschaert, or outside valve gear, main brass is as accessible as front and can be renewed in same time.

While a great number of these removable brasses have been applied and renewed on main journals and have given absolutely no trouble; unless journal was in perfect condition, I question the desirability of renewing main brasses in this manner, but unhesitatingly endorse method on all but main journals.

Brasses are held in place by taper key, the length of brass, which is driven in about $1\frac{1}{2}$″ at time of application and pressure of forty tons is required to press brass from box after being applied in this manner.

All parts of box are machined in special jigs which insure perfect interchange and extreme accuracy in maintaining standard sizes. Aside from the removable feature, the use of key permits the tightening of brass at any time and there need never be a loose brass in these boxes. This, to my mind, with the loose brass trouble most of us experience, is an item of vast importance and will appeal to all.

Another very desirable feature is the removable hub plates. These are made in two pieces, are of cast steel, recessed for babbitt filling and are held in place by bevel planed in hub face at bottom of box and special beveled casting or washer, engaging plates diagonally at both top corners, at these corners boxes are cored for enlarged circular head bolts, by means of which plates are forced down and in, making a very substantial bearing. The use of double nuts and cotters preclude possibility of plates becoming loose.

With this arrangement, lateral on a pair of drivers can, and is taken up in one and one-half hours.

Plates being interchangeable, it is good practice to keep a supply on hand, finished, with the exception of shaping babbitt on face to desired thickness.

There are about 550 boxes of this kind in service on the C. & N. W. Ry. on all kinds of power including the 2 8-0 type with cylinders 25 x 32.

There are also 125 engines under construction at Schenectady on order for this road, which will be equipped with the Markel boxes on all but main

journals, these being fitted with the Cole boxes having a shoe and wedge face, with 17", total width of box 21".

The Keystone journal boxes also have removable brasses and hub plates, though secured by different methods.

Grease lubrication fed to top of journal and tongue on cellar interlocking with grooves at lower end of box at cellar opening which keeps box from spreading, are radical and commendable departures from usual practice.

In conclusion, I believe thorough work on boxes, and methods of doing same which give results in service, is paramount to rapid and questionable methods which hurry engine through shops in remarkably short time, with results that very often engine is returned in equally remarkaby short time.

Question—Is there any gentleman here who has a right lead where the left crank pin is in advance of the right crank pin?

Most all of our boxes are cast steel.

We haven't flange enough to the driving box and we do not overlap the frame enough.

I attribute it to the width of the flange of the driving box not being wide enough to come through.

Mr. Logan: I find that that is a common trouble, that the boxes are too narrow.

And thereupon the discussion was deferred until after the reading of the balance of the papers.

Mr. Dickert read his paper as follows:

Driving Box Work, C. S. Dickert, Asst. M. M., Macon, Ga.

Being placed on committee of above subject to give my views on same, I will endeavor to state as near as possible each operation from the rough to the finished box applied to the journal. The time, however, will vary somewhat, depending on size of box, whether steel or cast iron, although the method of handling would be practically the same.

Shop conditions are to be considered, you cannot compare a small shop and old machinery with a large modern shop, fully equipped with the latest tools. Give the man credit who makes a showing working under difficulties; some of you are no doubt familiar with just such conditions and you are doing good work, and are the men that I like to hear talk. You are compelled to do something to make a showing, and as necessity is the mother of invention you have devised some handy and time-saving device in order to get results; the handy kinks you have will help the fellow with his modern tools.

The first and most important step is to perfect your organization. Get a good man lined out on this class of work, get him interested in the work, and you will get results. Have a system of handling the work from one machine to another; keep regular men on the machines if possible, and if this cannot be done, always use the same man on the job, that he might become efficient in this particular class of work; keep in touch with your men, go around and talk to them and see that they have the proper tools and that the machines are kept in good order.

It is quite interesting to watch progress on any one job, following it from the rough to the finished product, that is, if it is handled systematically. We will start and follow a lot of driving boxes that are to be machined, and observe very closely as we advance from one operation to another, from the time the box is first handled in the rough until it is placed on the journal finished. I will begin by having shop order issued covering, say, 16 driving boxes, to be machined for certain class engine. A copy of this order is furnished Machine Foreman who issues Storehouse order for so many pounds of casting, charging to shop order. This ticket is given to Material Clerk who delivers boxes to floating gang, to be transferred to Machine Shop and placed at a 52" boring mill, where the first operation begins. They are faced both sides and counterbored on hub side for liner, all boxes being made same thickness. They being finished for next move, are handled from mill to 15" slotter by jib crane, where they are slotted for brass and cellar fit. When this operation is completed, the brasses are fitted to boxes on same slotter. The slotter is equipped with special chuck and tools for machining brasses,

they being finished ready to press in box in one chucking. The man machining brasses, drives them in box with hammer to about one inch, to know he has the proper fit. They are then handled with jib crane from slotter to a 100-ton hydraulic press, where brasses are pressed in box. The drill press is located just a few feet from press, where the boxes are next handled for drilling holes in hub face for copper plugs, for holding on hub liner. Pouring on brass for hub liner is next operation, which is done in Copper Shop in easy reach of same jib crane used for handling boxes throughout the whole operation. We have a tilting furnace and use scrap brass for pouring on all hub liners; we find this much more economical than bolting liners on box. After liners have been poured on, they are placed at planer where they are clamped down to bed, hub face up, and a rough cut taken off hub face with head on cross rail, and cut down flanges with side head. This operation, to some of you, no doubt seems useless, but I find by having a true face to bolt up to angle plate, and flanges true to clamp down to planer bed, there is some time saved in chucking, as well as there being no danger of boxes moving under heavy cuts and feed, as there is when built up on liners. I have a double angle plate, or sections of angle plate full length of planer bed, thereby enabling me to machine a double row of boxes, using two heads on cross rail at same time. I have, in connection with angle plates, a device attached to cross rail of planer and angle plates for flaring the flanges, not having to unchuck the boxes and line behind them to throw them out of line for flaring. This device saves me four chuckings on planer, which amounts to not less than four hours to a setting of boxes. The boxes are finished in shoe and wedge face first, then the rigging is coupled up for flaring, which only requires a few minutes, When cut is taken down the flanges they are flared at same time. The time saved on this operation is the amount of time it takes to set the boxes four different times on an angle to make the four flares.

The boxes are next placed at draw cut shaper and cellars fitted, then moved to drill press for cellar bolt holes and plug holes to be drilled. The plug holes are all drilled same size, all plugs made and driven in.

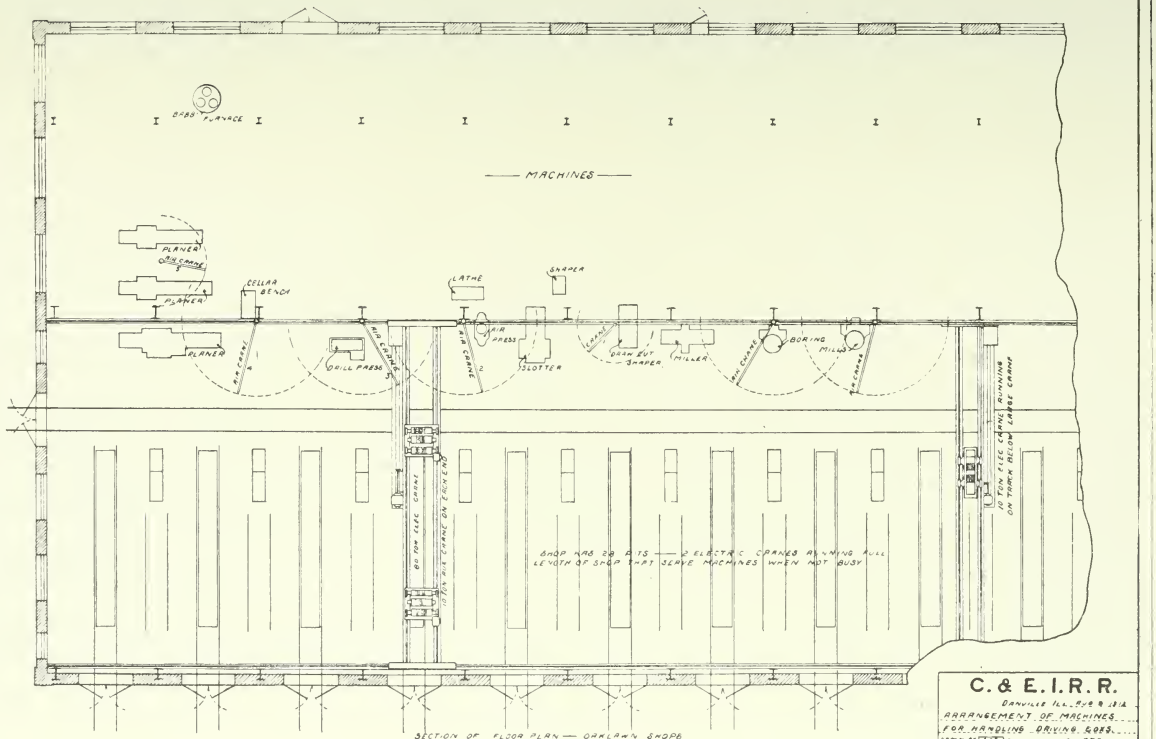
The boxes are placed in stock to be issued out on storehouse order and charged direct to engine.

We have in the driving box group a 36″ boring mill where all boxes are bored for journal fit and hubs faced. They are bored full, of journal size, and require very little fitting. After boring the boxes they are finished, all except fitting, by driving box gang; all cellars fitted for grease, with plates and all in place. When finished, Machine Foreman delivers to engine, using industrial cars and labor gang for delivery.

Boxes are delivered in storage bay, back of engine pits, where they are fitted to journal. In the storage bay we have two 7½ ton traveling electric cranes that are used for handling boxes on and off of journals. While boxes are being fitted by machinist, the cellars are packed and made ready to put in boxes by a laborer who has been educated up to doing this class of work. When applying cellars after boxes have been fitted, the boxes are put in a rope sling, under journal, cellar opening up, and lifted up to journal and cellars applied.

Repairs to Secondhand Boxes.

When wheels are removed from engine the boxes are knocked off of journals, all grease or dope taken from boxes and cellars and sent to oil house to be reclaimed. Boxes are placed with other parts removed from engine in a large basket and sent to lye vat to be cleaned, which is done with labor gang in Erecting Shop. After cleaning, boxes are taken to driving box gang who examine brasses, boxes and cellars. If the brasses are tight and thick enough to be used again they are not disturbed; if they are thick enough to use and are not too loose in box we tighten them with tin shives; and if they cannot be used again they are pressed out, broken up under steam hammer, to be melted and poured on boxes for hub liners. New brasses are fitted to boxes and pressed in. Copper plugs screwed in hub face of box, they are sent to copper shop for hub plating. Next move to shaper where they are straightened up, shoe and wedge face. Cellars are next re-fitted and they



SECTION OF FLOOR PLAN — OAKLAWN SHOPS

C. & E. I. R. R.

DANVILLE ILL. AUG 9 1912

ARRANGEMENT OF MACHINES.

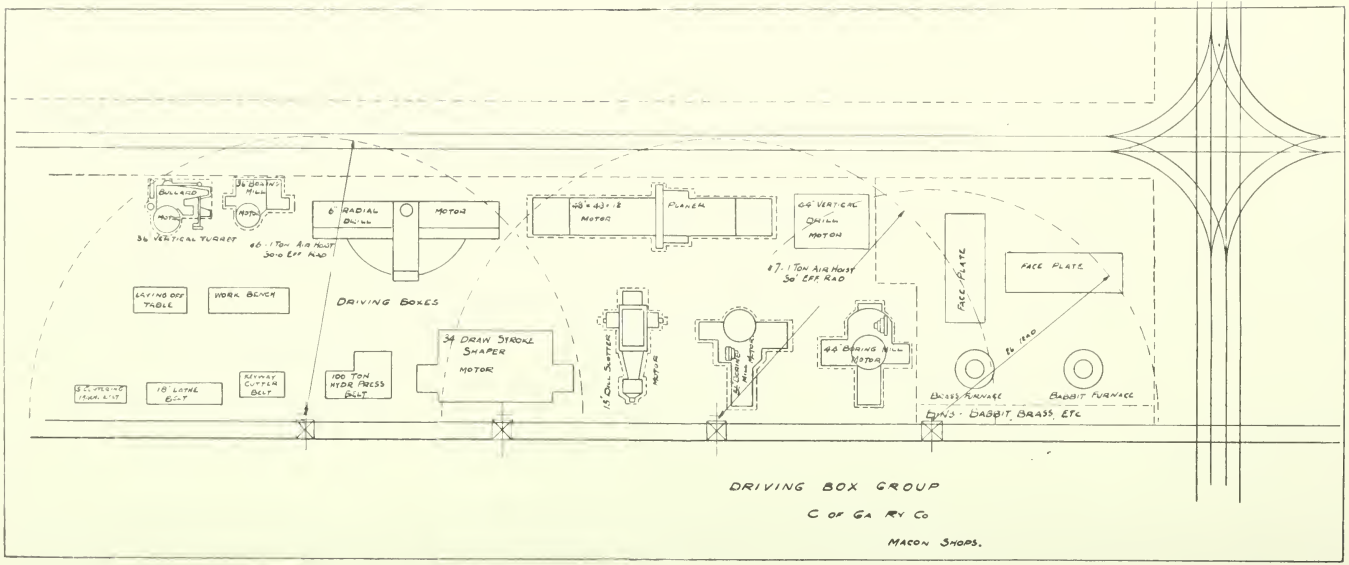
FOR HANDLING DRIVING BOXES.

DRAWN BY
TRACED
CHECKED

DRAWING NO. 91-5791

APPROVED
GENERAL SUPT.

APPROVED
M. M. E.



DRIVING BOX GROUP

C OF GA RY CO

MACON SHOPS.

are ready for boring mill to be bored for journal. This finished, they are delivered to engine.

Tools in this group consist of planer, shaper, slotter, two boring mills, drill press, hydraulic press and two work benches. Pneumatic hammers are used for all chipping. The brass furnace is within reach of the jib crane that serves this group. The crane is provided with air hoist for handling work, which makes it very convenient for transferring boxes from one machine to another with one man. This group has two 30-ft. jib cranes for serving, and in addition to jib cranes we have a 30-ton electric driven crane the entire length of Machine Shop for any transferring of material necessary.

Driving Box Work, C. M. Newman, General Foreman A. C. L. R. R. Shops, Rocky Mount, N. C.

Driving Boxes, with the Shoes and Wedges are the foundation of the machinery of a locomotive. For this reason it is necessary that these parts should be properly fitted up and maintained to as high a standard as possible. This work improperly done while the engine is in the back shop for general repairs or the proper adjustment neglected after the engine goes into service by the roundhouse forces, will be very detrimental to the entire machinery of the locomotive. There are no other parts of the machinery of a locomotive, if started out in the proper condition and given the necessary attention, which will increase its life any more than the shoes, wedges, and driving boxes.

The running repairs to these parts on the average locomotive due to improper methods and poor workmanship on them while the engine is in for general repairs, holds it out of service longer and costs more than the repairs to almost any other part of the machinery.

What we are striving to do is to reduce the cause of knocks and pounds which are responsible for a great deal of the broken frames, worn rod bushing, imperfect valve motion, etc., and by doing this cut down the cost of running repairs, build up the engine mileage and increase the time between shopping.

With these objects in view, we wish to bring out the best methods and the most economical ways to do this work, while the engine is in for general repairs, and at the same time reduce the necessity and cost of renewals of the heavy and expensive parts by applications to the wearing surfaces which can be renewed at a moderate cost and which will give good service. With these thoughts in mind, I have divided this subject into four parts.

1st. "Method of machining Driving Boxes, Shoes and Wedges."

2nd. "An economical machine grouping for this work."

3rd. "A good method to fit up shoes, wedges, and boxes and square the engine."

4th. "Methods of rebuilding wearing surfaces."

For information on these subjects, I have endeavored to obtain data from a number of the leading railroads of the country so that I could give you some of their methods and practices, also an idea of the time of performing some of their principal operations. In getting this data I have met with some success but not as much as I had hoped for. The data I have is based on the information I have gathered from twenty of the largest railroads of this country, representing about 21,353 locomotives.

Before taking up these subjects as I have them divided, I will start with an engine which has been placed in the back shop and raised from its wheels. The boxes are first removed form the journals. The packing is gathered and returned to the oil house for reclaiming. The boxes, cellars, shoes, wedges, and binders are placed in a lye vat or are hand cleaned. After this the boxes are delivered to the location for inspection, and the shoes, wedges and binders are turned over to the shoe and wedge gang for inspection. All defective boxes, thin or loose brasses, and all broken or condemned shoes and wedges are scraped. The binders, if they are of the type which have to be fitted to pedestals, are placed at their location on frames and marked showing the amount to be closed, and delivered to the blacksmith shop. This brings to a point where we will condiser second hand and new work together in order to take in all operations.

Part 1. "Method of Machining Driving Boxes, Shoes and Wedges."

The first operation in machining new driving boxes is to strike off the hub side and the opposite side. This is most generally done on a heavy planer, requiring from 30 minutes to one hour for steel boxes. This time only represents a few shops.

The next operation is the cutting of the crown bearing fit and the cellar fit; this, in some places is done on a planer or shaper, but most generally done on a slotter or draw cut shaper. The times on the machines most generally used are as follows, from one to three hours on the slotter and from fifty minutes to one hour and thirty-five minutes on the draw cut shaper. The draw cut shaper shows the best results.

The machining of the crown bearing is the next operation. There seems to be a variety of ways of performing this operation. Some shops turn the circle on a lathe or boring mill and plane the edges on a shaper or slotter; others do the whole operation on slotter, crank or draw cut shaper. The best times given are in favor of the draw cut shaper with special chuck and gauge. This is from seventeen to fifty minutes from the start of the operation to the time the brass is ready to press into the box. On the draw cut shaper, one chucking and one tool completes the operation. The brass is then pressed into the box, preferably by a hydraulic press.

The box is now ready for the machining of the shoe and wedge fits. This is most generally done on a heavy planer by clamping a number of boxes to an angle plate. The time for this operation per box ranges from one to three and one-half hours.

The cellars are then fit to the boxes, they are next delivered to the drill press to have cellar boltholes, plug holes and oil holes drilled. One road, I find uses a cutter in the drill press to cut the oil grooves for shoe and wedge face instead of the hand or pneumatic hammer, which proves quite a saving. At this point if there are any crown brass retainer plugs to be applied they are put in and then the box is delivered to the machine for crown boring. This is most generally done on a horizontal or vertical boring mill. The best time given is on a horizontal boring mill on which the facing of the hub bearing and boring of the brass is done in twenty-five minutes.

The machining of second hand boxes is practically the same as above, except, that the new work has some additional operations.

The general practice for machining shoes and wedges is on a slab miller or heavy planer, using a chuck which is so constructed as to allow the machining of outside of flanges and frame fits at one setting of the work. The number of parts to be set up at one time depends on the size and capacity of the machine. This is done on the slab miller buy sing gang cutters which finish outsides, tops and insides at one cut. On the planer it is done by using gang tools, of which a variety of holders are in use.

The best times given are in favor of the horizontal or slab miller, on which the average time per piece is from ten to twenty minutes. This time, to a large extent, depends on the quality of metal used. The time given for planers ranges from twenty to sixty minutes per piece.

The machining of the box bearing face on the shoes and wedges is most generally done on quick return planers or on draw cut shapers. The time for removing from $\frac{1}{4}''$ to $\frac{3}{4}''$ stock from castings, $5''$ x $20''$ ranges from fifteen to forty minutes. The best time given was when a special chuck for setting was used and a gang tool holder carrying two roughing, one finishing and one filleting tool to be used in succession on a special quick return planer.

It is said that the machining of the shoes and wedges on the outsides of the flanges is an unnecessary operation. Of the roads I have heard from, four are not machining them and have made no complaint.

Part 2. "An Economical Machine Grouping."

From the above will be seen that for an economical handling of this work we should have a slab miller, a heavy planer, a small powerful quick return planer, a draw cut shaper, with attachments, a horizontal or vertical boring mill, a drill press, at least a fifty ton hydraulic press and sufficient crane service to handle the parts from one machine to the other. With these machines so located as to have the work on these parts a continuous opera-

tion, there is no reason why a maximum output could not be obtained at a minimum cost.

Of the shops I have heard from, fourteen have a special machine grouping for driving box work.

Part 3. "A Good Method to Fit Up Boxes, Shoes and Wedges, and Square the Engine."

In fitting crown brasses to the boxes, it is well not to depend on the circle fit of the brass to hold it secure in the box. If the brass is too tight on the circle it will spread the box, and if it should heat when the engine goes into service it will close on the journal, and will, no doubt give trouble. The box legs, having been spread apart, will close in on the cellar and should it be necessary to remove it on the road or in the roundhouse, we all know about how much trouble we would have; then after it is removed the box has closed and the cellar will have to be reduced to be replaced.

You will now find the box closed on the lower end and we have started a pound in the shoe and wedge fits. By machining the brass to a good snug fit on the circle and depending on the edge or flat surface for the pressure, and taking care not to spread the box, you can eliminate these troubles.

The key or flat surface on the edge of the brass fit in the box and on the brass should be set at such an angle as to have a tendency to pull the box together rather than spread it when the brass is pressed in.

Boxes should always be planed with the brass fit central with the shoe and wedge fit, also the brass should be bored central with the shoe and wedge fit and care taken to prove this before the box is fit to the journal. Before boxes are bored for the journal fit, the journals should be made round, straight and true with the wheel and axle center. I have know journals to caliper round and straight but not be true with the wheel and axle center, but would be as an eccentric to it.

It is generally recommended on engines, using grease as a lubricant, to bore the main brasses 1-64″ larger than the journal, and all others $\frac{1}{32}$″ scant larger than the journal. This is to allow for a free distribution of the grease.

If a journal is in the proper condition, and the brass properly bored, there is very little time required for fitting in the back shop.

The pedestal jaws should be made straight and square before the shoes and wedges are applied. It is also a good practice to have them given $\frac{1}{4}$″ fillet on the corners, also have the shoes and wedges machined with a fillet. This will eliminate some of the shoe and wedge flange breakage. Shoes and wedges should be free on the pedestals and have a good face bearing. Shoes should have a good snug fit, top and bottom, so as not to be wearing the frames and binders at the ends of the shoes.

The binders should be well fitted to the pedestals, for poorly fitted binders are responsible for some of the pounds, broken frames and pedestals.

We now have all good journals, boxes planed central and bearings bored central and proved; frames have been set square; pedestal jaws made straight and square; binders, shoes and wedges fit and placed in their permanent location, and stretchers placed between shoes and wedges to hold them to their place.

The next operation is to square the engine. For this operation we must have a point to start from. If the engine has a lead truck it must first be made square and set central between the frames and cylinders as it controls the tracking of the engine. It matters not how perfectly square we have our driving wheels, the engine will not track properly if the engine truck is not properly squared and located.

As we have set the lead truck central between the frames and cylinders, we should use this same point to set the driving wheels. From this point a square center is found on the frames, generally at the main pedestals. From this center is located a center for the main boxes, governed by the thickness of shoes desired and the length of the main rod. The main box centers located, the other box centers are located from them, the length of the connecting rods determining the distance between. Of course each set of side

rods is made the same length or a standard length for each class of engines.

With all the centers located, and as the boxes are bored central, it is only necessary now to get set lines on the shoes and wedges for the planer. This is generally done by dropping a perpendicular line from the main box centers and locating two points on this line, a certain distance from the top of the pedestal. From this point, strike an arc on the flange of the shoes and wedges, using a radius, generally 1″ larger than one-half the width of the box at the shoe and wedge fit. Transfer one of these centers to the inside of the shoe, and use the distance between the outside set centers to locate the center on the wedge. These points on the shoes and wedges are the same distance from the top of the pedestal as the points on the perpendicular line. The main shoes and wedges are layed off for planing, it is only necessary to transfer these set lines or points to other shoes and wedges, using the side or connecting rods to determine the distance between.

This gives three points to set the shoes and wedges to plane the face. When planing, the face should be one inch from these set points. With an inch gauge it is a very easy matter to prove these faces after the shoes and wedges come from the machine. If care is taken in getting these points and the parts are properly handled on the planer, there is no reason why the engine will not tram and track properly.

Part 4. "The Method of Rebuilding Wearing Surfaces."

To restore second hand shoes and wedges to the required thickness, it is general practice to apply sheet liners, not exceeding $\frac{1}{4}$″ thick to the pedestal fit, and securing them by two or more rivets. These liners should be as near perfectly flat as possible and be securely riveted in place before the shoes and wedges are layed off for planing.

On most roads that are using cast steel boxes, brass inserts or liners are applied to the shoe and wedge fits to keep them to a standard. These liners are held secure by the boxes when being moulded, having dovetailed recesses or cavities left in the shoe and wedge fits, extending across them. In some cases, on second hand boxes, these cavities are machined diagonally across the shoe and wedge fit making two cavities diagonally the entire length of the box. The metal is poured on the box, using a mould to give the required thickness to allow for machining. By this method the life of a cast steel box is almost unlimited as far as getting too small across the shoe and wedge fit is concerned.

The hub or lateral wear is taken care of in a number of ways and by numerous applications. In some cases, brass is applied to the boxes or to the wheel hubs — in some cases babbitt is used — one road has made a test of brass on the wheel hubs and removable fibre plates applied to the boxes. The road which has used the fibre plate on the box gave it a three year test on heavy power with good results. It is claimed that the lateral on a ten-wheel locomotive can be taken up in from five to seven hours. These fibre plates are $\frac{5}{8}$″ thick and are held in place by a recess on the box, $\frac{5}{16}$″ deep; this taking care of a $\frac{5}{8}$″ wear. There are no bolts, nuts, clamps or parts to come loose on these plates.

A test is being made by one road of applying a removable collar to the axle next to the inside of the box, and applying brass liners to take up the wear. This being done without disturbing any other parts. I don't think this device has had a very long service test as yet.

The method most generally practiced is to apply metal to the hub side of the box or the wheel hub. When applied to the box, it is held in place by a counterbored cavity on the box and made secure by the application of pins.

I have a record of one road which has the boxes cast with this cavity. It is claimed that its roughness assists in holding the metal secure.

When pouring the metal on the boxes, on the hub or on the side for shoe and wedge face, some difficulty has been experienced in locating the oil holes. A method for preserving the holes has been suggested by applying a pin to the holes and around it apply a piece of small copper pipe. After the metal is applied, remove the pin and let the pipe remain in place.

In building up the hub of the wheel, the hub is bored out and a brass plate turned and cut and applied, being held in place by countersunk rivets

or bolts. Another is to have these plates cast in halves, with dovetail ends and fit them up and then machine to fit the cavity, securing them to the hub by countersink bolts. Another is to pour babbitt in the hubs to the proper width and thickness, using moulds, which will require no machining to the hubs. Another is to give the wheel a double dovetail counter bore and brake or make a nick in the sharp edges in several places to prevent the liner from turning and stand the wheels on end and pour brass on the hubs, building up to the required amount to allow for machining.

Of the roads I have heard from, fourteen use brass on the boxes or wheel hubs for taking up the lateral, four use babbitt, two use cast iron on the wheel hub and brass on the box.

President Scott: That completes the reading of the papers. We have been exceptionally honored this morning by having with us a man who is connected with one of the most alive railroads in the United States, Assistant Superintendent of Motive Power of the Chicago & Northwestern, and Fourth Vice-President of the Master Mechanics' Association, Mr. E. W. Pratt.

ADDRESS OF MR. PRATT

Mr. President and Gentlemen:

I had hoped when your program was announced that I would be able to spend part of several days with you. Unfortunately I was out in the wild and woolly West until yesterday and had no opportunity to listen to your papers. I was glad to hear something in regard to driving boxes. If there is anything, to my mind, that should be given prime attention by the round-house and shop, it is the foundation gear of our locomotives. Most all of us have some little frill or other. We are an expert setter, or we can do one thing or another that is perhaps more or less on the line of experts. But for me, give me the man who is a crank on the foundation gear of an engine, one who has his driving box, shoes and wedges right and the foundation gear of the engine in good shape; I find that the frills will take care of themselves pretty well.

My attention was called this week to a locomotive that was taken care of at the round house of another Company. The construction of this engine was such that you have to drop the binders to put in a wedge bolt. That engine had run, according to the engineer, several days with no wedge bolt whatever in the back driving box. Of course we could criticise the round house that won't drop a binder and put these wedge bolts in, but I believe we ought to look further and put up a construction so that a roundhouse does not have to take an engine apart in order to remove a small part that may require removing frequently.

I do not know whether you have talked in regard to the labor proposition or not. To me that is one of the live subjects. It has been in the past and is becoming more acute at the present time. On our road there is a tendency to employ in the shops, in both the car and locomotive departments, men of one nationality. We find that at one place they will have all Italians, at another, all Mexicans. I believe we should do all we can to break up that tendency of foreign nationalities clicking together. It comes naturally for a bunch of Austrians to send for their friends, and the first thing we know we have all Austrians. I believe if we would bear that in mind we would have less trouble and better satisfied men in the long run.

I am glad to learn that you had a very successful convention here. I know it is your last day and the attendance would not be as great as it had been before. I want to thank your President for giving me this opportunity to say a few words and offer felicitations.

Mr. Pickard: Mr. President, gentlemen and Mr. Pratt: At the call of the chair and in behalf of the General Foremen's Association we desire to thank you for coming among us this morning, giving us your experience on the questions that seem to be paramount in your estimation for the mechanical department operation. The gentlemen who represent the railroads from all over the country will benefit themselves and go back home with something good.

In regard to design, it is unfortunate that this association cannot be intermingled with men who design locomotives, and listen to the General

Foremen in the discussion of the various subjects as to the conditions that they run into. It is also unfortunate that the mechanical representatives of the various divisions do not sit in among these men and listen to the things that confront them, and they would see why a number of these things are not carried out to get the results that they want them to get.

As to the labor proposition, I think that is one of the greatest things there is before the American Railroads today. It has been my privilege to work from coast to coast on the different railroads and I have seen all sides of it. I have stood in the labor halls and in the Master Mechanic's office and in the office of the Superintendent of Motive Power and dealt with the question in a number of ways, and I believe that the labor question is the most important one we have to deal with. The General Foreman is the man who comes in contact with the men. In going about from place to place I find different systems of organization; and I have seen results from these different alignments on railroads where the mechanical department was intermingled with other departments. Invariably when that change took place there was a labor controversy took place. This question of management should be given consideration before they make any changes in the plan of organization. It seems to me that the only method for a railroad to work out is the piece work proposition. I have handled shops where they have been unorganized, partly organized and organized. At present I am located where they work entirely piece work. The usual rate of pay is 32 to 36 for machinists. Our machinists are averaging 42 to 43 at piece work. Some of our men are organized in the shop and some are not, and none of our men are leaving our shop and going to work on a day work proposition, because they are better satisfied working piece work. In the piece work proposition the men are looking for the foremen, and not the foreman looking for the men, as they are in the day work shops. It is true that the supervision is increased but with the discipline in the shop I do not think it would offset the benefits derived. I have extended piece work to the coaling of engines and wiping of engines, and in the last 20 days I have been cleaning fires piece work. Piece work is giving good results and we are keeping our men. I thank you very much for coming among us and giving us a talk.

DISCUSSION ON DRIVING BOX WORK RESUMED

President Scott: I would like to call upon Mr. Westbrook of the Grand Trunk to open this discussion. He is an expert in this line. It is only a few months ago that he had a very valuable paper on that subject.

Mr. Westbrook: I have watched your proceedings for years and envied some of you the opportunities of getting here, and this year I made a special effort to get up among you, but I certainly did not come up to speak. I came up to listen. I know it is a common practice for a man to get up and say that he wasn't prepared, and he has a pocket full of notes, but I am not prepared. I agree with the former speakers on driving box work. I am certain it is the most important operation of the locomotive. There are one or two little things I jotted down. There was mention made that the driving boxes or the wedges in some shops were not machined on the outside faces. It struck me, "how do they use the final plane on it; what would they true it up by?" It struck me that would be a reduction in the cost of the machining of the shoe and wedges, but I cannot see what they would true it up by.

Also mention was made of screwing the plugs in the driving box faces. In my experience that is unnecessary. Also it has been mentioned as to copper rivets. I notice some roads are putting in a taper plug from the inside. Is that necessary? I have never seen a plug come loose yet. A turned plug may come loose, but one that has been cast and driven in properly will not come loose.

It was such a surprise to be called on that I haven't anything special to say. I thank you for the opportunity of coming among you and permitting me to become a member.

Mr. Warner (L. S. & M. S.): I did not expect to be called on at this meeting as this is my only day with you. I can, however, give you a little

data on our method of handling driving boxes. The hub liners on our driving wheels are cast iron and the hub face on the wheel is dovetailed and the hub liner is caulked on. The hub liner on the driving box is cast brass. We pour the hub liner and the shell at one setting of the box, and hardly ever put a hub liner on without shell, altho we sometimes take up lateral without renewing the shell. The old brasses are pressed out of the boxes under the hydraulic press, the boxes are dovetailed both for the hub liner and the shell. We also pour our shoe and wedge faces on our boxes.

Mr. Masters: I think that the papers on the driving box situation have been very able and fairly covered. I do not know that I can bring out any particular things that are new along those lines. I might say that I was previously connected with the American Locomotive Co. as erecting shop and general foreman, and we saw about every driving box that was brought out, and of course new opinions from every country; from Canada, Brazil, China, France, Japan and South Africa. The design of course was largely the result of experience on these particular roads. Of course there is always something to learn. After going back to the D. & H. people as General Foreman of their new shops, we have developed one or two points pertaining to driving boxes that give entire satisfaction. One of these features is that we take the wheels, when we are about to take up the lateral, we have portable brass furnaces that we pour all the brass liners and the wheel hubs. In order to hold them we screw common patch bolts into the hub of the wheel. In pouring the brass, the brass grabs the patch bolts and holds firmly. We have not had any engines that run 40 or 50 miles an hour give us any trouble about the liners working loose.

The matter of wires on the boxes isn't so much a matter with us as we have a steel furnace of our own. When they get down then we renew them with new boxes. We have a little grease plug inserted in the hub of the wheel about $1\frac{1}{4}''$, each hub drilled almost entirely through to the line. Then we have a $\frac{3}{8}''$ from the body of the $1\frac{1}{4}''$ bolt leading through the liner. We fill the cavities with grease and stick in a plug. About every round trip the engine makes the plugs are turned and in that way lubrication is provided for the hub liner in the boxes and it runs nicely without any excessive lateral.

Mr. Dickert: The method we use for squaring the engines, we use a screw and copper plugs into a box device for the hub liner. We drive the plug in, and use the hub liner, fastened to the driving box spring saddle with a copper pipe running down to the hub; that is filled with hair or waste to strain the oil.

Mr. Hayes: There are one or two points that I did not understand. One was referred to by Mr. Westbrook as to not machining the outside of the wedge. I do not understand how that could be accomplished. And the other was in Mr. Dickert's paper as to preparing the flange of the box. I would like to know if that can be accomplished as he explains it.

Mr. Gale: It seems to me that as mechanics we are all under the impression that the proper procedure in connection with the driving box proposition is the proper machining, squaring and setting up of the necessary details in that connection, and we should try to determine by the various practices of the representatives of the various roads what is best. And the next important question it seems to me in connection with this subject is the cost of the work. Mr. Logan, the Chicago Northwestern representative, has gone into detail, as far as his road is concerned. That does not necessarily say that they are correct, or that we have the best practice, or are getting the best results, and we are here to learn from others, if we can, as to better methods for doing this work.

Mr. Newman in his paper stated, I believe, that the quickest and possibly the best method of machining driving boxes was on a slab mill where they use milling cutters and that it took from 10 to 20 minutes. I would like to ask if I am correct. Did Mr. Newman in summing up that proposition take into consideration the necessary work in reboring jig tools or the gang cutters, or did he take the actual operation of the cutters over the boxes? We have tried the milling cutter idea, and I think we have practically abandoned it as being a failure under present conditions. I claim, from the tool

room foreman at our place, who has the handling of these cutters, that it takes all the way from 18 to 20 hours to renew these tools, or put them in proper condition for operating again, after they have been used up and I can assure you on the steel boxes they use up very rapidly. And it is a question in my mind as to what is the ideal condition under which boxes can be planed. These are the questions we want to thresh out in order to get the best results. I may not be correct as to Mr. Newman's position and I would like to have him explain it when the time comes.

Mr. Pickard: The committees that have prepared these papers, in my estimation, have covered the ground in a very good way, as I like the proposition generally. Another thing should be taken into consideration when you first start in on a commercial basis. That is what the railroads are looking for. We should study our cost as well as our methods of doing the work,—as to which is the most profitable for the best results.

Our method of treating the driving box work may be different from some others and I can give you the benefit of that. Our operating conditions are very severe. We have 1½ per cent grades and our engines are in the corner full stroke from 1 hour and 15 minutes to 2 hours and 25 minutes, so our driving box parts wear and the maintenance is quite a proposition. In our last new power all the driving boxes are of the cold design; with this increased length on the journal our results have been most excellent. The maintenance of those with regard to setting up the wedges was a proposition with us at first. They were not properly maintained on account of the great wearing surface of these wedges. The engineers as well as the shop forces did not get it up where it belonged. We started a campaign on that immediately, and as I have charge of the division I said to my road foreman of engines and traveling fireman: "You two fellows go down on the cinder pit and catch all the freight power coming in after the engineers have left the engines; stay down till I tell you to come back. After the engineer has made his inspection you go over the engine and let the traveling fireman get up and throw her over and see where his boxes and wedges are and make a report in addition to the engineers', a copy to come to my office and a copy to the General Foreman's office, on the terminal that you are making the inspection on." There was a great big difference in the traveling engineer's and traveling fireman's findings than that of the regular crew's. We found after that that it was necessary to change our organization in the roundhouse in order to keep up the wedges where they should be kept. We built up our organization to meet it. We inspect every engine and set up all wedges and line down every one where necessary. That is looked after by a special handy man and his helper, and the same continues over all of our points.

In the shop operation we have gotten away entirely from as much machine work as we can. We pour all our brasses and our hub liner, and make the brass and hub liner one complete piece of brass. This secures the brass to the hub liner. We find we do not lose a hub liner and necessarily no brass working away from the hubs. While we are not the originators of the pouring (the Lake Erie & Western of Lima were the first people to practice this), still we believe it is a good proposition and we are carrying our work out in that way. The first essential thing is to get the box to the temperature so that when the contraction of the box takes place the box will go back and be somewhere near the brass. We heat our boxes drawing over a gas furnace with which our shop is connected throughout. We put a check in it and the box is placed on a surface plate and the ribs on a mandel are tapered, and the box can be pulled away from it. We eliminate the machining of the hub plate in three operations: Pouring, turning the outside diameter and facing the part that goes next to the box. We also eliminate the turning or slotting of the brass. I would say that the machine operation, where you put your brass in, that it can be done to better advantage on a draw cut shaper, as there is only one operation to take care of. The only machine operation we have left is the turning off or facing to the proper thickness of the flange. We pour our main box as near as possible to a running fit so as to leave no rock wearing upon the grooves, to distribute the grease to all parts of the journal. We are careful in fitting our grease cellars that the box will not close on the journal and cause it to run hot as the box wears.

Another important thing is the maintenance of these cellars in the engine house. Men who take care of these should be thoroughly instructed as to their proper maintenance. I have invariably run into conditions in my travels through the country of men pulling out these perforated plates and sticking them in the firebox to burn off the old grease, and the contour of the perforated plate is changed so that the open places admit air and cause a carbonization of the grease. Wherever it is away from the journal it is opened up and the journal is deprived of the grease that it should receive. We built a series of mandels and our instructions are to use steam in cleaning, away from the fire lines so as not to destroy the circle of the perforated plate, and we find that our results have been materially incresaed by so doing.

Another important part to watch is the way these are fit to the cellar. Be sure that they are free and easy with the plate that follows; that the plates do not catch on any of the rivets and that the housing is secure and comes in contact with the perforated plate.

Another thing is to check your packers and see that they do not get too much grease. Where we have sharp curves to contend with, if the grease is held away, you will find that you will run into a number of hot boxes from this one particular source. I find in a number of those housings that just recently came out of the Locomotive Company on some 25 new engines, that they would taper as the plate traveled up and they had a lot of trouble after they feed up about one-half. So when they are pulled down it is essential that they travel the entire length of the housing.

Another important thing is the plan under which the machinery is located in your shop. It has been my privilege to go through five or six of the shops that have been built in the last five or six years, and some of them only in the last year, and you would find one operation in this end of the shop and the other one way down to the other end of the shop, where trucking was necessary to get them back and forth. That is one important thing that engineers in shop construction should be careful to notice—the proper location of the machine tools so as to eliminate as much traveling back and forth as possible.

Mr. Pratt: Until a short time ago we were throwing away all our driving box grease, and in case any of the rest of you are doing the same you can get Mr. Ashmore how to reclaim 9-cent grease.

Mr. Ashmore: We have an old cylinder rigged up with a strainer at the outlet and we squeeze it through the strainer holes $\frac{1}{8}''$ in diameter, and it cleans it well enough so it can be used again. We make it up into sticks for driving box grease for switch engines.

Mr. Mullen (L. E. & W.): I believe that Mr. Pickard has covered our way of taking care of driving boxes. We pour them the same as Mr. Pickard claims his Company is doing; pouring the shell in the box and the hub liner with it, and also pour the shoe and wedge face. The only thing different, we heat the box hot enough that they do not have to jack it apart. It expands at least $\frac{3}{8}$ of an inch. We find that the brass contracts and the box contracts, and we think we get better results and do not have as many loose driving box brasses by heating in this way. We fit our cellars up just as Mr. Pickard explained. In some cases where the holes are hubbed in very heavy we use patch bolts to fasten on the cast iron hub liner.

Mr. Smith (P. & L. E.): I came to listen but I might explain our way. On our passenger engines and freight engines we use cast iron liners. The hub of the wheels are counter-bored $\frac{1}{4}''$ to $\frac{5}{16}''$ deep; the liner is then turned up so that it will fit into the hub, and then secured with a soft brass plug. The faces of the driving boxes are poured 3 inches to the width, $\frac{5}{16}''$ deep and dovetailed on both sides, and on the freight or road engines we use Babbitt. The driving box shell is turned up on the lathe and pressed in from the hub side to the shoulder. Our driving boxes are pretty nearly all steel. You will find if the men are careful in making the fit to the box that you will not have very many loose brasses. If a bad fit on the brass, the work is loose. On our passenger engines we use a cast iron hub liner on the wheel and a brass hub liner on the box. That is poured out with a square gooove probably 3 inches wide or $2\frac{1}{2}$, and fastened with soft brass plugs. Our truck

boxes, the same way on our passenger engines. On the freight we use Babbitt. We did have some trouble with the brass liner working loose on the passenger engine truck boxes.

Mr. Corbett (M. K. & T.): We handle our boxes practically the way the man over there spoke of. We pour the brass in. The only thing they do there that I don't, and I believe I like it pretty well, too, when we pour the boxes we pour them as near the size as we can, more especially in the main than the other. We do not do any fitting of the boxes. After we get through shaping we pour the brass on for the hub plates. We do not remove the hub plates on a wheel only when worn down to a certain thickness.

As to shoes and wedges, I was under the impression that flange breakage was due to the fillet on the shoe and wedges and the box. We took the fillet of the shoe and the wedge and the box and fit them up. We give a little advantage on the shoe and wedge over the fillet on the box, and we get a good pouring on the fillet, and we do not have very much trouble with broken flanges—broken in every way only at an angle.

Mr. Dickert: I want to ask about the practice of flaring the driving box. Are they doing that as a general practice? Some roads put a flare on the shoe and wedge.

Mr. Reyer: The face of the shoe, we reduce on top and bottom, just leaving boxing face the length of the bottom. The man from the Chicago Northwestern said that when the engineer had a little time he would set up his wedges. I want to know if they have chain gang engines or regular men?

Mr. Smith: Mr. Reyer has brought out one point I intended to mention and that is the shouldering of driving boxes. I notice principally on account of the roundhouse gang not being able to set up wedges, that the shoulder and wedges and sometimes the driving boxes slightly show that. If the shoe is cut down for 4 inches about 3-64 or $\frac{3}{32}$ that trouble is eliminated. Mr. Logan brought out in his paper about the trouble of broken flanges resulting from the thrust of the main rod and the coal box was brought out to overcome that; that the longitudinal force is much greater than it has been in the past and up to this time driving boxes have always been designed to hold the load of the engine, and these box joists are extended by means of a cross-tie and the boring is by means of a saddle. The railroad companies are realizing the advantages to be derived, shown by the fact that a great many locomotives are equipped with these boxes. The lubrication of the shoe and wedge surface is a matter that is very important. I notice that there are a number of roads that do not resort to any sort of a groove along the shoe and wedge. Some roads use a sort of a countersunk groove. The American Locomotive uses an arrangement for conducting water around to the oil box, that brings it down to the bore of the shoes and wedges. The New York Central has a practice of getting the oil back at the back of the shoe and wedge, and it allows the oil to settle down in the back of the wedge. I notice that some roads use a cast steel box against a cast iron shoe and wedge. I consider that poor practice because there is no anti-friction metal there and there is a scouring that causes considerable trouble among the shoes and wedges in the roundhouse. There is more or less cutting and the result is that the wedges cannot be properly adjusted. The practice of applying a machined box is too expensive. Pouring the brasses is much cheaper and gives equally as good results. I have noticed a driving box arrangement for applying the boxes to the wheels that is used in the West Albany shops of the New York Central and the D. & H. also has it. It is nothing more or less than a runway and it has two trolleys that run the entire length of the runway. The runway is spaced just the distance between the two driving boxes, and the practice of the Railroad Company is to drill all driving boxes with an eye hole, and with this air hoist the box can be readily lifted and placed on the journal. It is a good method of fitting the driving box to the journal.

Most shops have to accept the machine tools that are given to them to do their driving box work with. That is what we are interested in more than anything else—trying to bring out shop kinks that can be easily adjusted in order to facilitate the work, and to rearrange the machines so that the driving box work can be facilitated as much as possible.

The horizontal boring mill offers some advantage in that the table can be very easily shifted and it requires no special jog or fixture to hold up the box.

The vertical plate for boring out the driving box offers an advantage that the boring mill does not present. I have noticed in the last mentioned shop that the Lucas forcing press is used and it seems to me it is superior to the hydraulic press. A great many have applied these forcing presses.

Mr. Logan: I am in doubt as to the shoe and wedge face that Mr. Westbrook referred to. Do you refer only to the shoes and wedges carried in store house stock?

Mr. Westbrook: I want to say that they do not machine the outside flanges of the shoes and wedges.

Mr. Newman: We tried that out on our road some time ago, but unless you can get a good casting with a good smooth surface, we found some trouble in making it fit with the planer. Of the number of roads that we heard from there were only four that were not machining, so it is not a general practice.

Mr. Logan: That leaves me with one question and that is Mr. Reyer's, as to whether wedges set up by engineers are manned by regulars. The engines run by regular engineers do a little more of the work. I wish to emphasize the fact that the method of machining is not as essential as the proper machining or the thoroughness of the work.

Mr. Dickert: Mr. Westbrook asked a question in regard to screwing in the plug. He is of the opinion they must screw through the plug; that is, screw in the face of the plug.

Mr. Newman: I think the first one was asked by Mr. Gale about the machining of the driving boxes on a milling machine. My paper does not mention that.

Mr. Gale: I was under the impression that it meant the shoe and wedge face.

Mr. Newman: The shoe and wedge face is not on a plane.

President Scott: That closes the discussion of DRIVING BOXES. We will now listen to a paper prepared by Mr. Walter Smith on

ENGINE HOUSE EFFICIENCY

Topic No. 5. Engine House Efficiency, W. Smith, Chairman.

Commercial Importance.

The business of a railroad is the sale of ton-miles. Hence the motive power is like cash in hand. Everything, then, that helps toward the effectiveness of the locomotives means increased earnings for the company. Efficient locomotive performance, however, is largely determined by the engine house. Therefore, an efficient engine house will give a correspondingly good engine performance. By engine house efficiency is meant the handling and repairing of power to give the highest grade locomotive performance that can be brought about by reasonable costs and minimum time of detention.

General Conditions.

The subject of engine house efficiency can only be treated in a general way due to the many and varied conditions that are met with, such as the number of locomotives to be handled, and the class of service they are engaged; also the class of traffic on the road, and the number of grades and curves encountered. Again if engines are pooled, the tonnage ratings excessive, and bad water conditions are met with, the problem is still further complicated. In fact there are an infinite number of conditions that have their bearing on the subject.

Locomotive Design.—The design of locomotives, as far as the round house is concerned, is almost uncontrollable, except that recommendations can be made to re-locate inaccessible parts and to re-design parts that are unreliable.

Then there are certain desirable features that can be recommended for promoting efficiency in the engine house, such as boiler checks with shut off valves, attached, which make it possible to grind in checks with engines

steamed up, and syphon cocks located on the dome for conveniently blowing off steam. Pistons with long rods that can be pushed far enough ahead to renew cylinder packing, without cutting rod loose from the crosshead, are also to be commended. As a move in the right direction, locomotives are being turned out of the locomotive works at the present time, with an auxiliary dome or manhole cover which makes interior inspection of the boiler possible without removing the throttle standpipe.

Standards of Comparison.

In order that the relative efficiency of engine houses may be compared, the performance of locomotives handled should be computed on the cost, time, and mileage basis. This comparison should be made under the following heads:—(1) Cost of engine repairs per mile; (2) Per engine cost of handling; (3) Mileage per engine failure; (4) Mileage between general repairs; (5) Average time of detention; (6) Per cent of the total number of engines despatched, furnished on time. These items are more or less related, hence it is possible to make a showing on one or more at the expense of the others.

Ends to be Attained.

The aim of the round house management should be to make the highest possible mileage between shoppings and engine failures, to minimize the time out of service due to handling and repairs, to keep the cost of handling and repairs down to the lowest possible figure, and lastly to furnish engines on time.

It is the purpose of this paper to discuss the above items separately, and to deal in a general way with the methods of attaining the results.

Cost of Repairs and Handling.

That local conditions largely determine the cost of repairs is shown by the fact that the cost of repairs per mile in this country varies from 4 to 16 cents. Reduction in cost per mile can be brought about, however, by making the best possible use of the men and facilities available together with good judgment, and economy in the use of material.

In order that the foreman may be the judge of whether material is needed or not, he or his assistants should write out all requisitions for material.

The scrap value of some of the material removed from locomotives amounts to considerable. Hence workmen should be required to bring the scrap material to the storehouse in exchange for the new. What material to require an exchange on, will readily suggest itself. Metallic piston rod and valve stem packing should be mentioned, as most kinds have a scrap value of about 20 cents per pound. Parts that can be reclaimed, such as engine truck, tank, and trailer brasses should be exchanged in the same manner. This method will tend to keep the house in a tidy appearance, and less time will be consumed in sorting scrap.

Nothing about the round house should be allowed to go to waste — even dirty waste can be reclaimed, and condemned air hose can be made into throttle gland packing.

As an aid in reducing the cost of repairs, tire shims, guide liners, driving spring clips, shoe and wedge liners, etc., should be kept in stock in sizes for use on engines handled. Also, blow-off cocks, injectors, gauge cocks, boiler checks, and air brake appliances such as feed and reducing valves, should be kept on hand so that the round house man instead of making repairs himself, can substitute a part that has been repaired. This method is a time and money saver.

The importance of a well stocked storeroom cannot be overestimated. When repair parts are not in stock, the broken parts have to be expensively patched, or new ones have to be made at great expense, or else the engine is held out of service while the repair part is sent for. The stealing of parts from one engine for another which is a fruitful source of trouble and expense, is also an outcome of lack of material. Of course when motive power is standardized it is easier to keep the necessary material on hand, due to the fewer variations in the size and design of the parts. This in turn reduces the costs.

Enginemen should be educated to report work accurately. Shot gun

reports, such as "Engine blows," run up the cost of repairs. It costs money to pull valves and take off cylinder heads.

Round house kinks and handy devices when developed to meet the existing conditions of power are great time and money savers.

Labor conditions in the vicinity affects the cost of handling somewhat, but much can be done in the way of reduction by a good organization. Organization will be discussed later.

High Mileage Between Failures.

Causes of Failures.—Engine failures will occur as long as there are locomotives in service, and it is only by eternal vigilance, on the part of everybody concerned, that they can be held to the minimum. There are innumerable causes for engine failures some of which are uncontrollable as far as the engine house is concerned, such as defects in material and design, and poor workmanship during construction and general repairs.

But, by far, the greater number of failures are caused by the lack of skill, care, or judgment, upon the part of those in charge of inspection, repairs, or handling. Failures are sometimes caused by the neglect of the foreman to have the proper repairs made, either because of poor judgment in deciding that the work reported was unnecessary, or in the oversight in not having the proper repairs made.

Over anxiety to get engines back on their regular runs, after they have received heavy repairs, is a common cause of failure. Good judgment would dictate to run such engines on unimportant runs a sufficient time to develop unexpected trouble.

Prevention of Failures by Discipline.—The problems of engine failure largely concerns the human element. Hence to keep down engine failures, the human element must be controlled, and that means good discipline. Discipline when properly administered will do much to eliminate failures. In some cases, friendly censure or words of caution may have the desired effect, in other cases it may be necessary to resort to suspension.

Each failure should be promptly investigated, and if possible traced to the individual or individuals responsible. As aids in this direction complete reports should be required. The chief train dispatcher should notify the master mechanic, by wire or telephone, immediately after the occurrence of a failure, and in addition should send in a daily report of engine failures.

In every case of failure engineers should be required to make out a complete failure report — preferably on a special form provided for that purpose. Some roads furnish a printed form, which when properly filled out by the engineer, gives all the information in detail. Of course these forms are the dread of every engineer, and they will do everything possible to prevent a failure, if it is for no other reason than to save themselves from making out one of these forms.

Another report should be made out by the round house foreman, in which he should give such information as, the cause of failure in his estimation, the work that was previously reported, and by whom it was done.

When enginemen, inspectors, foremen, and workmen know that each failure will be traced to the individual responsible, and the blame placed accordingly, they will take every precaution to keep blame from their shoulders.

In order to have the desired effect on the men, a daily report of failures on the division should be posted in a place accessible to all. Most roads compile a record by divisions; it is a summary of engine failures from each cause on each division, and for the whole road. In order that comparisons may be made, the total number of failures, and miles run per engine failure, is shown for the previous month, and the corresponding month of the previous year. This report should also be posted, as it has a tendencey to create a feeling of rivalry between the men of the different divisions, and it gives the men to understand that they are in a measure responsible for results.

The scheme of giving round house men a bonus for discovering defects that would cause an engine failure has considerable merit. This bonus is given in so many hours off with pay, depending on the importance of the discovery.

Prevention of Failures by Taking Necessary Precautions:—When a number of failures occur from the same source, it is sometimes possible to prevent a reoccurrence by taking certain precautions. As an example of this, a certain road had an epidemic of engine failures due to blow-off cocks sticking open. In most every case it was found that a piece of a staybolt or the burr from the bead of an arch tube, kept the valve from closing. Failures from this source were eliminated by requiring the mechanics who removed staybolts or arch tubes to fish out the pieces from the mud ring, and deliver them to the foreman.

A large number of failures occur from hot bearings — especially in high speed service. As a preventive measure, engines should be equipped with a water line, and when new brasses have been applied to engine truck, tank, or trailer journals, the engineer should be notified to that effect by a suitable tag tied to the throttle.

The same sort of a tag can be used to notify him that wheels have been changed, or that lateral motion has been taken up, in the trucks. With this information at hand the engineer knows just what to look out for.

Periodical Examinations and Tests.—As a means of preventing engine failures, and of improving locomotive performance generally, periodical examinations and tests have not been given the attention that they warrant. Of course the Federal boiler law defines how often boilers, staybolts, steam gauges, and pops must be tested so that is not a matter of choice. Aside from these required tests, there is no general practice — in fact, only at the most efficient engine houses has the matter been taken up.

Just what work should be performed periodically, and what the intervals should be, is largely a matter of conditions, and appliances used. If tank water scoops are used, they should be gauged each trip, and if compound locomotives with intercepting valves are in service, the intercepting valve should be examined at least every three months. Superheater locomotives have presented new problems of maintenance, and where best results are obtained the superheater tubes are tested with water pressure at three months intervals, and the cylinder packing and valves examined monthly.

To prevent trouble from hot driving boxes, the perforated plates in grease cellars should be examined monthly, and cleaned off if necessary — this to insure a good feed of grease to the journal. All hard grease should be removed from the cellar at this time, and the box re-packed.

Other work that is performed periodically at different engine houses consists of removing drawbar pins each month for inspection; cleaning out tanks each month; draining main air reservoirs each week; gauging height of drawbars and pilots each week; examining piston nuts and follower bolts of built-up pistons each month; testing air brakes each week; examining smoke box draft arrangements and ash pans each week, etc. When periodical examinations and tests are made, it is very important that a suitable record should be kept of each.

In order to prevent failures from air pumps not working, air pumps should be changed every six months.

High Mileage Between Shoppings.

In order to get maximum mileage from engines between shoppings, all inspections should be made in a thorough manner, and all adjustments and repairs should be given immediate attention. Aside from this, there are certain features with regard to locomotive maintenance, which if controlled will greatly prolong the life of an engine between shoppings. The first is, unnecessary or excessive flange wear of driving tires; in some cases this may be overcome by re-spacing tires or putting engine in tram. The second is: excessive lateral motion in drivers; this may be prevented to some extent by keeping lateral well taken up in engine trucks and trailers. The third is: improper condition of driving boxes; this may be prevented to a large extent by well maintaining shoes and wedges. The fourth is: lost motion in rods and connections; this is controlled to some extent by keeping driving boxes in proper condition. It is also necessary to renew a rod or knuckle bushing occasionally, and to keep the main rod brasses reduced.

As an aid to making high mileage between shoppings, square valves should be mentioned. When valves are properly adjusted the engine can be worked lighter to do the same work; thus saving wear and tear on the machinery.

An engine can be kept in service for so long a time that while the cost per mile run will be apparently low, and while getting over the road without failures, the cost per ton mile may be very high. This should not be mistaken for efficiency.

Time of Detention or Terminal Delay.

The earning power of a locomotive is at least $20.00 a day, and in most cases a great deal more. Hence, when there is more business than can be taken care of, every hour that an engine is tied up means something.

Every effort should be made to get engines in the house after they arrive. Engine crews should not be allowed to wash up on the engine, and it may be advisable to limit the time an engineer is allowed for inspection.

Some terminals are handicapped for want of stall room. In this case, as soon as engines are ready for service they should be put outside, on the circle or on the storage tracks, to make room for engines that require work.

On some roads the round house is required to furnish to the division superintendent and master mechanic a Terminal Delay Report. This report is made out for a 24 hour period, and gives the following information for each engine that departed during that time; time of arrival at the ash pit, time of engine in the house, time engine ready for service, time used in preparing engine, time ordered, time out of the house, total terminal delay, and the cause of any unusual delay. The time used in preparing engines and the total terminal delay are averaged for all engines that left during that period. This report offers an excellent means of checking round house performance.

Engines Late Out of Round House.

Delays due to engines late out of the round house are costly, not only on account of the delay to the service, but because of the delayed time that must be paid to the engine and train crew.

In most cases these delays are due to negligence, oversight, or poor judgment on the part of foreman or workmen. Hence as a step toward the elimination of delays from this source, they should be traced to the individual, the same as failures, and the blame placed accordingly. In fact the whole matter of preventing delays can be handled in much the same way as failures.

A number of delays result from the failure of appliances to operate, when engine is about to leave the house. In most cases the appliance has been worked upon, and the workman expected it to operate as it should. To prevent trouble from this source, appliances that have been worked upon, should be tried or tested beforehand.

Organization.

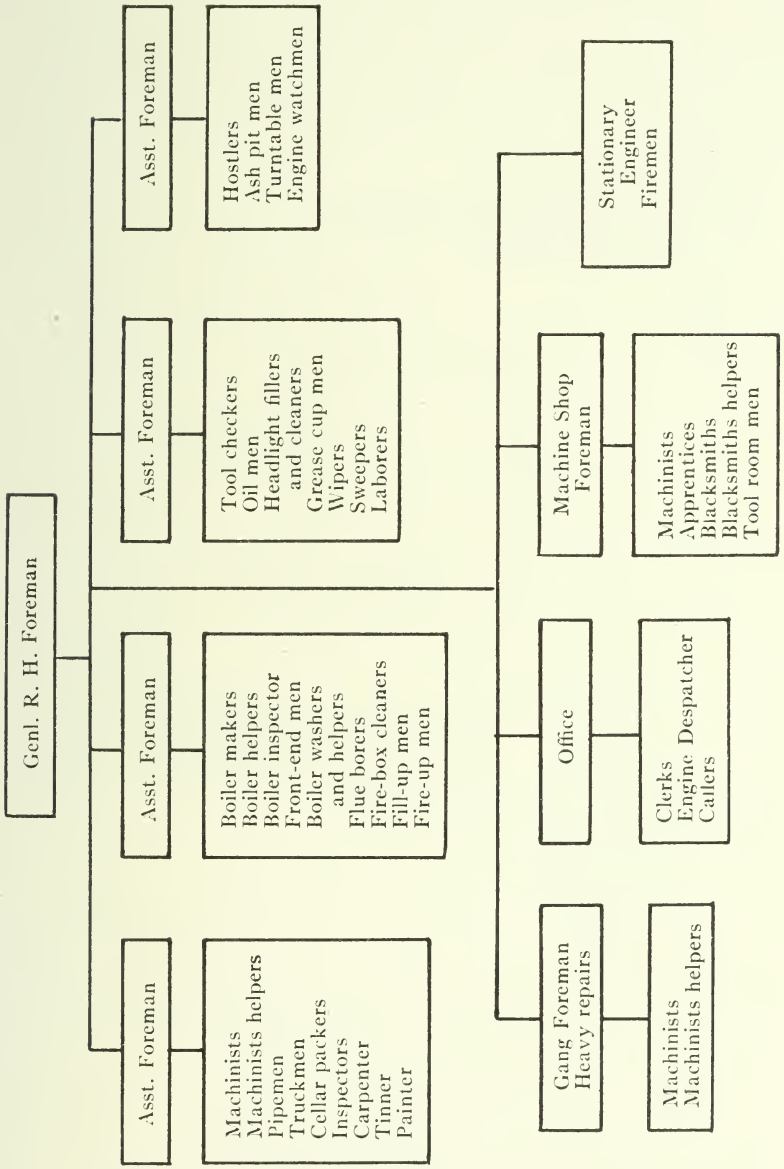
The importance of a good organization in the engine house cannot be over estimated. In fact, it is the keynote of the whole situation. Even when the conditions are favorable, and modern facilities are provided, if the organization is not on a sound basis, the results obtained will be inefficient.

By organization is meant, "the selection and assignment of men, and the distribution of responsibility for results." Hence, in an efficient round house organization, each foreman and each workman should have his duties clearly defined, and should be given to understand that he is responsible for the work he performs.

An organization to be effective must also provide for the loss or transfer of workmen or foremen — that is, there must be men trained for every job so that when absences or vacancies occur, the operation of the round house will not be affected in the least.

Then the selection of men should be given some attention, and not by the common method of "Hiring and firing."

An organization to be effective must have enough supervision to relieve


Genl. R. H. Foreman
Asst. Foreman
Machinists
Machinists helpers
Pipemen
Truckmen
Cellar packers
Inspectors
Carpenter
Tinner
Painter
Asst. Foreman
Boiler makers
Boiler helpers
Boiler inspector
Front-end men
Boiler washers and helpers
Flue borers
Fire-box cleaners
Fill-up men
Fire-up men
Asst. Foreman
Tool checkers
Oil men
Headlight fillers and cleaners
Grease cup men
Wipers
Sweepers
Laborers
Asst. Foreman
Hostlers
Ash pit men
Turntable men
Engine watchmen
Gang Foreman Heavy repairs
Machinists
Machinists helpers
Office
Clerks
Engine Despatcher
Callers
Machine Shop Foreman
Machinists
Apprentices
Blacksmiths
Blacksmiths helpers
Tool room men
Stationary Engineer Firemen

the foreman of too much detail work. There is no question but that the inefficiency of many round houses is due to lack of supervision.

The round house foreman should be directly responsible to the master mechanic for results, but the latter should not interfere with the actual supervision of the engine house, as such a practice is sure to spoil the authority of the foreman with his men, and consequently the organization as a whole is weakened. The master mechanic should communicate all instructions, suggestions, and criticisms directly to the foreman, and not to individual workmen or assistant foremen.

After an efficient organization has been perfected, the problem that confronts the foreman is to maintain it. This is a question which largely concerns his personality. He should be a firm disciplinarian, and at the same time should have the good will of the men. He should be quick to think and act, and above all should be a keen observer. It is important also that he should be able to key up the organization when the power is badly needed. A spirit of loyalty among the men is one of the greatest aids to efficiency in the engine house, and that can sometimes be brought about by an occasional word of encouragement.

Plans of Organization.—Two methods of organization, which are shown in the accompanying charts, are intended to meet average conditions. The first is for the average engine house which handles engines mostly of one class, either freight or passenger. The second shows an organization especially adapted for large main line engines house, handling both freight and passenger power. The second differs from the first in that separate foremen are provided for freight and passenger repairs. There is much to commend in this plan, but it has the disadvantage of bringing some of the workmen under the supervision of two foremen at the same time.

These organizations are intended for engine houses segregated from the back shop. In this case moderately heavy repairs are usually made, and hence a heavy repair gang is provided. A heavy repair gang aids to the efficiency of an engine house, because it offers a means of getting immediate action on a rush job, and it is valuable to the organization because it gives a place to draw men from, when there is a shortage in other gangs.

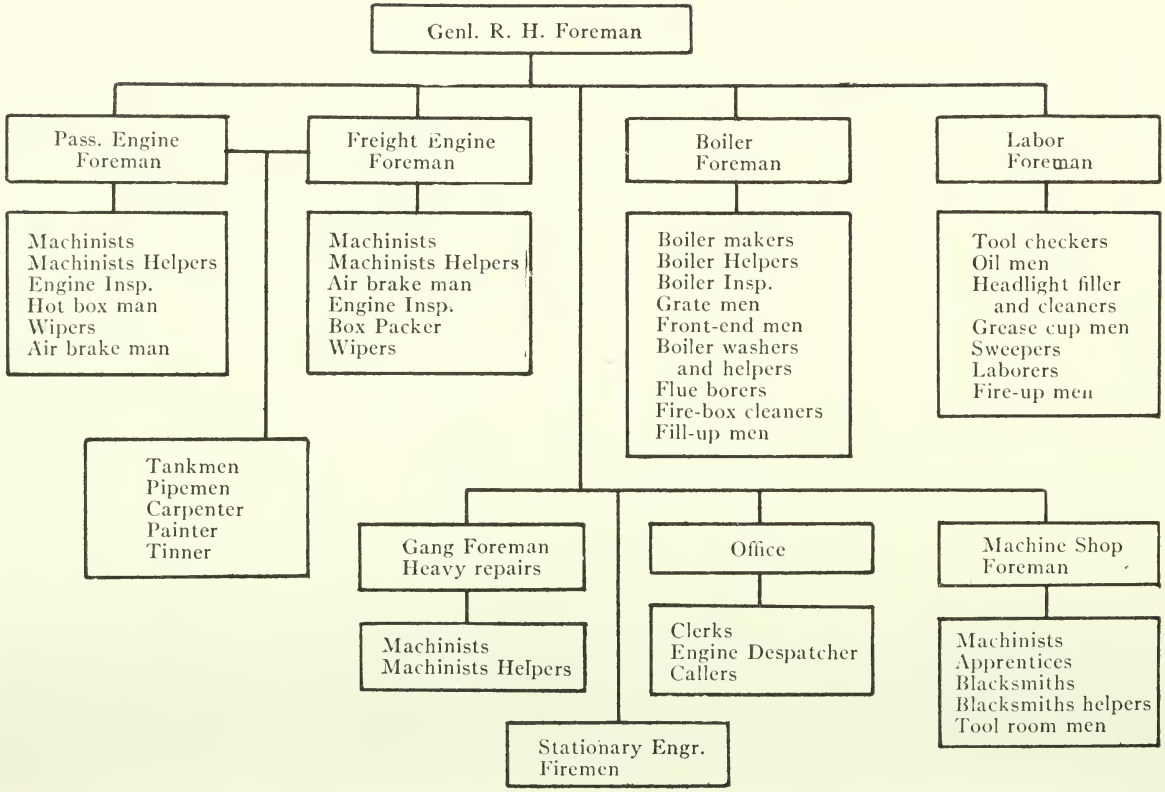
Specialization of Work.—In order to get highest efficiency, work should be specialized as far as consistent. Of course the size of the engine house will determine how far this system can be carried. When work is specialized, the special men most generally have the special tools required, and are thoroughly familiar with the work. In large engine houses there should be special men assigned to such work as rods, valves, air work, cab work, and so forth. In choosing specialists some attention should be paid to individual proficiencies.

When this system is used, there should be several all around running repair men to take care of work that does not come under the specialists, and to help out on certain work that is behind.

Round House Operation.

The aim should be to operate the round house on the basis of a machine All movements of the locomotive, from the time of its arrival on the round house tracks until its departure, should be given the closest attention. The longest delay before an engine is run in the house ordinarily occurs at the clinker pit. Hence the need of especially close supervision at that point. If enginemen are educated to bring in engines, with plenty of steam, full of water, and not excessively heavy fires, an efficient gang of fire knockers can cut the delay down to a surprisingly low figure.

Ordinarily, washing out is the longest operation performed in the house. By all means, there should be a hot washing and filling system, together with a blowing down line, so that this work will be facilitated as much as possible. Then if every minute is taken advantage of, after the engine stops in the house, the delay from this source need not be more than two hours. In this connection, it should be mentioned that the time to bore out flues is when boilers are washed, and it should be the practice to bore out flues thoroughly every time a boiler is washed.


Genl. R. H. Foreman
Pass. Engine Foreman
Freight Engine Foreman
Boiler Foreman
Labor Foreman
Machinists
Machinists Helpers
Engine Insp.
Hot box man
Wipers
Air brake man
Machinists
Machinists Helpers
Air brake man
Engine Insp.
Box Packer
Wipers
Boiler makers
Boiler Helpers
Boiler Insp.
Grate men
Front-end men
Boiler washers and helpers
Flue borers
Fire-box cleaners
Fill-up men
Tool checkers
Oil men
Headlight filler and cleaners
Grease cup men
Sweepers
Laborers
Fire-up men
Tankmen
Pipemen
Carpenter
Painter
Tinner
Gang Foreman Heavy repairs
Office
Machine Shop Foreman
Machinists
Machinists Helpers
Clerks
Engine Despatcher
Callers
Machinists
Apprentices
Blacksmiths
Blacksmiths helpers
Tool room men
Stationary Engr.
Firemen

After boilers are washed more or less time is consumed getting steam on engines. Of course the skill of the fire-up man counts for something, but the method of firing up, and the intensity of the house blower, are equally as important. There are three methods commonly used for firing up, and each method has its advocates. The first method makes use of the crude oil firing up machine, the second makes use of shavings and oil, and the third makes use of wood and oil.

Work such as the filling of grease cups, cleaning and filling of headlight, etc., should be performed as the engines come in the house, and not after they are ordered as is sometimes the custom.

In large and busy engine houses mechanics should work on eight hour shifts. Thus the twenty-four hours in the night and day can be divided into three shifts and there will be men working at all times. In this way running repairs can be taken care of promptly, and without the necessity for overtime.

Operating Board.—As a means of keeping tab on all engines in the house, as to how near they are ready, etc., the engine house should be provided with an operating board. On this board all operations that may be performed are listed, and it is the duty of the workman who performs the operation to check or O. K. the board when the work is completed. A board intended to suit average conditions is here shown. As soon as an engine arrives in the house, the hostler helper who came in with it, should mark down the engine number, together with the stall number. One of the foremen should afterwards insert the division name. If an engine is for the back shop, or it is to be held 24 hours or more for repairs, he should also insert:—"Held for Repairs," or "Held for Work," so that workmen can give other engines the preference.

Washout Board.—There should also be a washout board to show when engines were last washed out. For the sake of convenience, there should be a space on the board, to give numbers of engines due for washout.

Other Boards.—As a convenient means of communicating certain information to hostlers and others, there should be a suitable blackboard located in the hostlers quarters. This board should give such information as engines due for washouts, engines that are not to be coaled on arrival, etc.

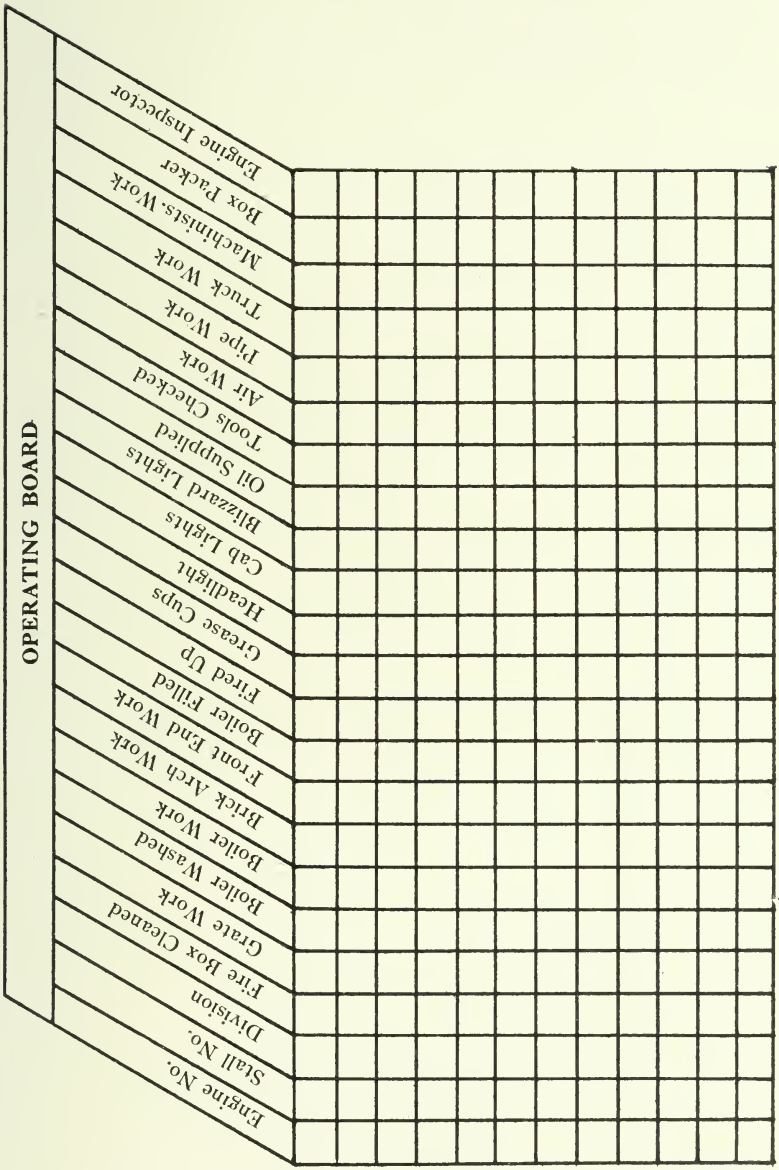
The turntable house should also be provided with the same sort of a board, to inform turntable men what engines are due for washout, or to call their attention to certain engines that are to be spotted on the drop pit to have wheels changed, or anything of that sort. Even if there are no especial stalls set aside for boiler washing, it should be the aim of turntable men to put engines in stalls that are not next to fire walls. If anything turns up after an engine is in the house, that makes it necessary to move the engine to the drop pit or to another stall, if engine is dead, the boiler should be filled with air from the house line, and moved by that means. This is a much quicker and cheaper method than firing up the engine.

For a matter of record it is necessary to know the time of each engine in and out of the house. Turntable men should be provided with a suitable book, or form, in which to keep this record.

Round House Information Book.—In order that the day and night foremen may inform each other of any unusual occurrences, and that they may give each other the necessary information concerning the condition and disposition of power, a running log should be maintained. The method of keeping this log is shown below. It represents the turn over from the day foreman to the night foreman.

Thursday, April 15, 1913.

3009—This engine held to have superheater pipes ground in.
3015—Extra engine to be used in place of the 3009.
3828—Hold this engine and crew for a special that will be ordered around midnight.
3888—Extra passenger engine. Fired to protect night trains.
3810—Hold for the back shop on arrival. See that the tank is not coaled up.


OPERATING BOARD
Engine No.
Stall No.
Division
Fire Box Cleaned
Grate Work
Boiler Washed
Boiler Work
Brick Arch Work
Front End Work
Boiler Filled
Fired Up
Grease Cups
Headlight
Cab Lights
Blizzard Lights
Oil Supplied
Tools Checked
Air Work
Pipe Work
Truck Work
Machinists Work
Box Packer
Engine Inspector

3660—Just in. Spotted on the drop pit to have No. 2 tank wheels changed, on account of cut journal.

The day and night engine dispatchers should maintain a separate book, giving the engine crew situation. A third book should be kept by the boiler maker foremen to give a line-up of the boiler work. These information books, while not strictly official, should be filed for reference.

Dispatching System.—It is very essential that some good method be employed to keep track of engine crews. In this case, the time honored blackboard should be replaced by a system of tags or blocks worked out to meet the special requirements.

Locomotive Maintenance.

The degree of perfection, to which locomotives are maintained, largely determines the mileage between shoppings and the mileage between failures. When repairs are neglected not only is the cost greatly increased but effective service is correspondingly impaired. Hence no engine should be allowed to leave the round house with any reported work left undone, if it will in any way affect the operation of the engine.

Locomotives may be maintained in a high state of efficiency by a well organized force of mechanics, together with a careful system of inspection, and by reliable work reports.

Inspection.—In order that arrangements can be quickly made for doing some heavy work, or that an engine may be immediately ordered out again, locomotives should be inspected at the earliest possible moment after they arrive. Some roads have gone so far as to provide inspection pits on incoming tracks, and engines are inspected as soon as they reach the terminal, and before the engineer leaves. Thus the reports are in the hands of the foremen before the engine reaches the house. Where outside inspection pits are not provided engineers should be encouraged to hunt up foreman immediately after their arrival, if they have any extraordinary repairs needed, so that preparations can be made.

The question of a detailed inspection is a very essential one, and to get best results the work should be specialized as much as possible. In the ordinary engine house, handling both freight and passenger power, there should be an engine inspector for passenger engines, another for freight engines, a boiler appliance inspector, an air brake inspector, a front end and ash pan inspector, and a boiler inspector. The duties of each inspector should be clearly defined, either by sheets of instructions or otherwise, and they should not be called upon to help out on work outside of their regular duties. One road has gone so far as to furnish inspectors with printed instructions.

Whether inspectors should be required to do any of the actual work of making minor repairs or adjustments, found necessary, depends on conditions. Ordinarily, engine inspectors can replace missing cotter keys in the time it would take them to make out a written report of it. Hence in most cases it is advisable to require them to put in cotter keys. Some round houses provide the engine inspector with a helper whose duty is to follow along and tighten loose nuts, put in cotter keys, etc.

It should be the duty of the boiler appliance inspector to try injectors and gauge cocks, and test the steam heat, on all engines; also to make a thorough examination of the cab, and report any steam leaks that may exist in valves or joints. At boiler wash periods he should examine water glass and gauge cocks and bore them out if necessary.

It should be the duty of the front end and ash pan inspector, and his assistants to make inspections of every thing to do with front ends, and ash pans, and to make all necessary adjustments, and repairs. The testing of superheater tubes for leaks should also come under this inspector.

It should be the duty of the boiler inspector to make boiler tests and staybolt examinations, and see that boilers otherwise meet the requirements of the Federal Boiler Laws. He should also keep his eye on the work of the boiler washers, and see that they use full pressure in washing, and remove all plugs.

The duties of engine inspectors are too well known to need enumeration. Their work should be closely supervised, and they should be called to account

for any oversights, whether or not failures or delays result from same. The failures that occur on other divisions should be used as object lessons to keep them keyed up to their duties. Occasionally their attention should be called to certain important defects that may occur; also to defects that are peculiar to certain classes of engines.

In order to prevent engineers from becoming lax in their inspections, it is the custom in some places to send them a mimeographed form stating that they overlooked important defects that the engine house inspector had found. In each case a copy is sent to the master mechanic.

In connection with inspection, the duties of the hot box man or doper should be mentioned. There should be one assigned to passenger engines and another to freight power. The passenger engine doper should inspect the sponging in all truck boxes each trip, and do what oiling and packing is necessary. It should also be his duty to watch all truck brasses, and renew them when they become worn or give trouble from running hot. In addition to these duties he should inspect driving box grease cellars each trip, and be responsible for their maintenance. In the case of freight power it is not necessary to go over the sponging in boxes each trip. In most cases once a week will suffice; the sponging in all tank boxes should be pushed up to the journal at that time.

Reporting Work.—Ordinary running repairs should be made on the basis of written reports made out by the engineer and inspectors. Unreported work discovered by round house men or foremen should be recorded for a matter of record. The work reported by the road foremen of engines and traveling firemen should be handled in the same way as the engineers report, but especial attention should be given to them, as their discipline is hurt to a great extent, and their usefulness impaired, if no notice is taken of their reports.

Two methods of reporting work are in general use; the first makes use of a special form, and the second a work report book. Probably the most satisfactory method is to have a work report clerk to whom the engineer dictates a memorandum of any repairs or adjustments that he considers necessary. Each separate subject is given a special space. After the report is entered the engineer reads it, and if satisfactory to him he personally signs it. This method has the advantage of keeping the reports clean and legible, and of giving the foremen a better idea of what is required.

Recording Work Reports.—Work slips should be made out from the work report book or form with a special slip for each job. Preferably the slip should be a special form about 3x5 inches, with blank spaces for the job to be done, the engine number, date, and signature of the workman. When blank paper has to be used it should be in the pad form and about five inches wide. Each job should be listed separately on the sheet, and then torn off with a paper cutter. A work report, slipped out in this way, is shown below.

3967—Left main driving box runs hot.
3967—Examine right valve for blow.
3967—Adjust bell ringer.
3967—Open sanders.

Each slip when torn from the sheet should be at least an inch and a half wide. The back of the slip should be left blank for the signature of the workman. Work reports should be marked with a check, when they have been slipped by the clerk — this is to indicate that items have been made out on slips.

When a special form or card is provided for work slips they should be filed away for reference when the work is completed, and they have been properly signed and dated. If the work is slipped on ordinary pad paper, it is necessary to have a special reference book with the work reported on the left hand side of the page, and the workman's name opposite the job on the right hand side. Of course in this case the clerk will have to check over all work slips turned in and sign the workman's name in the book opposite the job he performed. When this is done the work slip is of no further use and can be destroyed.

It is very essential that some system be employed to take care of incom-

plete work reports — that is, work reported but not done when engine was last in the house. It often happens that it is impossible to do all work reported before the engine leaves the house, but if the incomplete work slips are properly filed away the work can be attended to on the return of the engine, provided it has not been done at the other end of the road. Such slips should be signed and dated on the back by the foreman, together with a brief explanation why the work could not be done, such as "Too short time," "No material in the store room."

It often happens that work is reported which upon inspection by the foreman is found to be in good condition. Such work slips should be given his O. K. and filed away for reference as finished slips.

At the end of each work period the finished slips should be gathered up, and properly filed or recorded, while the unfinished slips should be turned over to the incoming foreman.

In all cases the work report books should be at the disposal of the enginemen, so that they may know what work has been reported by the inspectors, and by the man who came in on engine; also that he may know what work has been done and by whom it was done. With this information at hand the engineer can inspect the work that has been done, and can make sure that the mechanic has not left any nuts loose or cotter keys out. It also gives him a chance to look after any brasses that have been reduced, or anything of that sort.

Instructions with Regard to New Appliances.—Experience has demonstrated the fallacy of introducing new appliances without proper instructions. The makers of appliances, in order that the success of their appliance may be insured, furnish blue prints, and cards of instructions regarding the care and operation of same. These blue prints and cards of instructions should be posted for the information of round house and enginemen. In addition, the master mechanic will do well to post, in bulletin form, any new information that may be of value, or that may come up from time to time.

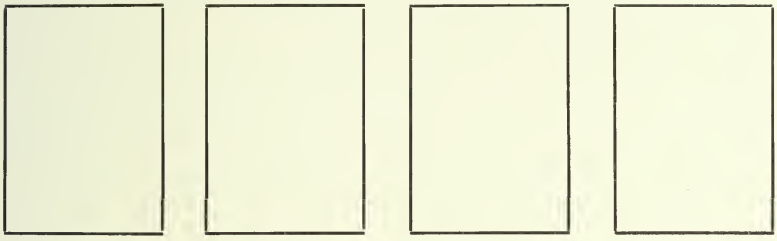
Distribution of Work.—In order that the engine house foremen may have an exact knowledge of all work that has been reported, and that they may pass judgment as to how thoroughly the work is to be done, and also that the engines may be promptly reported for service when work is completed, the work foreman should distribute the work slips personally. As far as possible, he should examine the work reported before the slips are distributed, so that mechanics will not waste time doing unnecessary work. He should also make sure that engines are blowed off before he gives out such work as to grind in gauge cocks.

In this connection it should be said that the work foreman can do much to promote efficiency by properly analyzing the work slips. If the same work is reported on the same engine a number of times, it is evident that there is some disturbing influence; it should be his duty to find out just where the trouble lies. It may be that a rod pin runs hot; instead of doctoring the pin each time it is reported, the engine should be trammed up, or otherwise examined to determine source of trouble.

Work slips can be very efficiently distributed and collected by means of the work distribution board. This board consists of a number of tin boxes, which are each divided into two parts — one for work slips that are to be done, and the other for finished work slips. Each workman is assigned to a box, and his name is stenciled below it. The boxes are each about $3 \times 4\frac{1}{2}''$, and each compartment $1\frac{1}{2}''$, which is the usual width of a work slip. When a workman finishes the slips he has, he goes to the board, deposits the finished slips, and then takes the new consignment. The method of arrangement is here shown.

Work Not Done Report.—Some master mechanics require a daily report from the round house foreman of work not done on engines, together with the reason why not done (a suitable mimeographed form being supplied). This gives the master mechanic a chance to get after the one who is responsible for running repairs being neglected. It may be that there is a shortage

Work Distribution Board.



J. Davis	E. Smith	T. Brown	W. Green
Machinist	Pipeman	Tinner	Carpenter

of power so that time is not available to make all repairs, there may be a shortage of material in the store house; perhaps too few mechanics are allowed; or the foreman may not be making the best use of time and men at his disposal.

Standard Practices.—The system of standard practices, that has been introduced on some roads, is without doubt a great aid in the maintenance of locomotives. There is no question but that considerable waste and inefficiency results when work is done according to varying individual judgment and opinion. When standard practices are used, the allowable limits of wear, the conditions under which to renew worn parts, the lateral to be allowed truck boxes, etc., are definitely determined.

In some cases where standard practices are not used on the entire system, individual master mechanics have framed up a number of rules, with regard to the allowable limits of wear, the application of piston valve rings, etc. These are for the guidance of foremen and mechanics, and when closely followed out are an aid to efficiency.

Engine House Equipment and Facilities.

There is no question but that modern equipment and facilities will do much to increase the efficiency of an engine house, but it is usually conceded that they are of secondary importance to methods and organization. Unless very heavy repairs are to be made, expensive equipment such as traveling cranes will not as a rule, give a fair return on the money invested.

Turntable.—The value of a good turntable and tractor cannot be over estimated. The cost of delays that result from a poorly operating table would sometimes pay for a new installation. The turntable should be high power driven so that unnecessary time is not spent spotting engines, and that there may be some margin of power for very bad weather. There should also be a positive lock to prevent derailments due to improperly lined tracks. The tracks should line up with the table at both ends, or the turntable motor should be provided with a drum and clutch attachment, so that dead engines may be easily pulled in or out of the house.

Drop Pits.—Drop pits are a very essential part of the round house equipment, even when heavy repairs are not the rule. The rapid wear of truck wheels under large capacity tanks, and the frequent mishaps to trailer wheels makes it necessary to drop wheels at frequent intervals.

In the ordinary engine house there should be two sets on separate tracks, each to cover two or three pits as required, one being of a size and suitable for driving wheels and trailers, and the other for engine and tender trucks. This drop pit section should be adjacent, or as near to the machine shop as possible.

The drop pit section should be equipped with a trolley hoist or jib crane, and as far as possible all heavy repairs should be concentrated in this section. The tool room should be located in this part, or as near to it as possible, so that everything needed is at close range.

Tool Room.—By all means the tool room should be run on the check system, and not only should the man in charge see that tools are returned and kept in order, but he should make necessary repairs as well, and otherwise see that tools are ready for immediate use. The room should be large enough so that the entire tool equipment can be kept there, including jacks, pinch bars, etc. It may be necessary to keep the larger sizes of jacks outside, and in that case a suitable platform should be provided, and workmen should be required to return them to that place, when they have finished using them. In this case also the man in charge of tool room should be responsible for their maintenance.

The tool room should contain a supply of the regular tools needed such as sledges, bars of different kinds, small jacks, grab chains and a variety of kinds and sizes of wrenches. Then there should be a sufficient number of pneumatic tools to meet the demands. A number of differential chain hoists of different capacities should also be a part of the equipment.

In addition to the regular tools there should be special tools such as piston pullers, spring pullers, and kinks that have been devised to meet the special conditions of power.

There should be combined with the tool room a sub-store room, which should carry a certain stock of bolts, nuts, washers, cotter keys, small pipe fittings, etc. This will avoid unnecessary trips to the store room.

Portable Tools.—Ordinarily, a considerable part of the time of mechanics is consumed getting together necessary tools for the work. In order to facilitate matters, some of the mechanics should be provided with portable tool boxes, which should contain all the tools for the special work they are assigned to. This tool box can easily be wheeled to the place where the work is to be done, and obviates the need of workmen running back and forth to their tool drawer or to the tool room for necessary tools. These boxes are also convenient to stand on for some kinds of overhead work.

A portable tool box and work bench combined is still more valuable for certain special workers. Of course a good vice must be attached to the bench.

To facilitate moving from one engine to another, all special tools such as boring bars, valve setting rollers, tire setting outfits, etc., should be mounted on suitable wagons. When not in use these should be wheeled to a special place provided for them.

A portable floor crane for handling cylinder heads, pistons, main rod ends, and other heavy parts below the running board is a very valuable addition to the tool equipment of any round house.

Some means should be provided for moving heavy parts such as pistons, and side rods to and from the machine shop. A special two wheeled wagon, with a long tongue will answer the purpose very well. Some round houses are provided with a narrow gauge industrial track, which extends around the outer wall of the inside of round house, and to the machine shop, store house, etc. Small push cars are operated on this track for transporting heavy parts and material.

To prevent boiler washers from dragging the washout hose from one engine to another, they should be provided with a cart on which is a reel for rolling the hose. A place should be provided in the body of the cart for carrying wrenches, nozzles, etc. This scheme also has the advantage of keeping the hose off the floor when it is not in use.

Maintenance of the Engine House.—Air, steam, and water leaks in and about the engine house not only cause rapid depreciation, but they reduce efficiency as well.

In order that the floor and walls may not be damaged when engines are run ahead too far, a good design of stop block should be attached to the front of rails.

Machine Shop and Air Brake Room.—When the engine house is segregated from the back shop, and fairly heavy repairs are to be made, a complete machine shop should be provided. The following machine tools are recommended to meet average conditions:

1 – 16″ Bolt Lathe.
1 – 18″ Lathe.
1 – 24″ Lathe.
1 – 20″ Drill Press.
1 – 40″ Heavy Drill Press.
1 – 22″ Shaper.
1 – 48″x 48″ x 8′ Planer.
1 – 36″ Boring Mill.
1 – Bolt Cutter to take up to 2″.
1 – Turret Head Bolt Cutter $\frac{1}{2}$″ — $1\frac{1}{2}$″.
1 – Pipe Threading Machine.
1 – Cut-off Saw.
1 – Emery Wheel.
1 – Hydraulic or screw press for driving box brasses, rod bushings, etc.

A boring mill is a rather expensive machine, and if conditions do not warrant the added expense, an attachment for holding rocker boxes, driving boxes, etc., to the carriage of a lathe can be obtained. This can be adjusted to any height. The boring bar is carried on the centers of the lathe, and as heavy a bar as is possible on a horizontal mill, can be used.

The air brake room should be located in the machine shop and it should contain all the special tools for maintaining air brake apparatus. Suitable testing racks should be provided, so that feed valves, etc., can be tested before they are applied. Here, also, repairs should be made to special appliances such as superheater dampers, lubricators, injectors, etc.

A blacksmith shop equipped with at least one power hammer, and one or two open forges should be operated in connection with the machine shop.

Telephones and Air Signal System.—In order that the round house foreman may get in rapid communication with various under-foremen and others, at large terminals, there should be a telephone system between master mechanic's office, round house office, clinker pit, coal shute, and other points that local conditions will determine.

In every large round house more or less time is spent by the different foremen looking for each other when something important turns up. As an aid in this direction, an air whistle can be located in some convenient place in the round house, and a suitable code of signals can be arranged. This system of signaling has been installed in Los Angeles engine house of the So. Pacific, and with splendid results.

General Considerations.

Condition of the Engine House with regard to Heat, Light, Ventilation, etc.—Cleanliness, light, and good ventilation, are most important factors in engine house work; they not only keep the workman in better condition for his duties, but they make him more alert. In the first place good natural lighting should be obtained by a large amount of window space. In the second place it should be obtained by keeping the windows clean. The best method of keeping windows clean is to use a window swab into the brush of which is discharged a stream of warm water, furnished from the hot water line by a suitable hose. White washed walls have a tendency to lighten up an engine house. Hence once a year or oftener the walls should be white washed with a spraying machine operated with air.

Electricity should be used for artificial lighting, preferably of the enclosed arc type for general lighting, and with incandescent lights for between stalls, over benches, etc. By all means, there should be at least two sockets between each pit for extension or portable lights.

In order to keep all kinds of scrap material off of the round house floor, it is the custom in some engine houses for mechanics' helpers to carry out all scrap material, as it is removed from engines.

As a means of keeping waste and other refuse out of pits, and off of the floor, a number of galvanized iron cans should be distributed throughout the engine house.

Instead of sweeping round house floors, they should be washed with a suitable hose connected to the hot water line. By this means two good laborers can clean out a fifty stall round house in less than a day's time.

The ventilation should be such as to keep the house comparatively free of smoke and steam. A good design of smoke jack will accomplish much in this respect, if due care is taken to keep engines that are fired under the jack.

In cold weather the doors should be closed, and the heat supply should be sufficient to keep the house at a comfortable temperature. The heating system should preferably be of the hot air fan type, due to its splendid ventilating properties, and its ability to quickly melt the ice from engines.

Locker, wash and toilet rooms are necessary adjuncts of every round house, and they should be kept in a clean and sanitary condition.

Pits should be cleaned out regularly, and the drains should be kept open at all times. Drop pits should be given especially close attention in this regard.

Maintenance of Equipment.—Too much stress cannot be put upon the importance of properly maintaining all equipment in the engine house. Drop pit jacks, due to their peculiar location, are apt to be overlooked.

Safety.—A round house that makes no provision for the safety of the men has overlooked one phase of the subject of efficiency. Even when conditions are the best, there are more or less dangers connected with engine house work, and it is only by eternal vigilance that they can be prevented. Care should be taken to have boards a good fit around the drop pit, and they should be put in place immediately after the pit has been used. Engines should be properly blocked with chains or specially made shoes of wood, and no engine should be moved unless proper signals of warning are given, so that a workman in a concealed position has time to take warning. In order that there will be no danger of blow-off pipes coming off, while steam is being blowed into the blowing down line, the connections should be examined occasionally, and if connections are worn they should be renewed. For safety, and other reasons, only authorized persons should be allowed to move engines.

Appearance of Engines.—The appearance of locomotives is a matter of pride with most master mechanics and foremen. Aside from the moral effect on the men, which is a considerable gain in itself, clean engines have a practical value as well; inspection and repairs can be more readily made, and they attract the attention of the traveling public.

With the numerous front end preparations, now to be had, it is an easy matter to keep front ends in good appearance. Occasionally cab roofs should be painted with a protective paint, to prevent deterioration, and to liven up the appearance.

The round house organization should include a painter whose duty should be to touch up the numbers and letters on engines and tank when they become dim and dirty. When this practice is followed, engines will look well from one shopping to the next, if they are carefully wiped each trip.

Reports and Records.—It is absolutely necessary that an engine house office should have a good filing system, so that any records, blue prints, or instructions can be readily located and referred to. Records of all periodical examinations and tests should be kept in as brief and comprehensive a manner as possible. Reports to the master mechanic should be made out on standard forms, or on specially prepared mimeographed sheets. In fact all clerical work should be systematized as much as possible.

In order that assistant foremen may have a place to do their writing and make out their reports, a small office should be located at some convenient place in the engine house. It need not be larger than to contain a desk and a stool. All engine houses on the New York Central are provided with these offices, and they are considered indispensable to the operation of the engine house, as workmen come to this place for orders and instructions.

President Scott: It is too bad we could not have had a full attendance for the reading of this paper.

Mr. Pickard: I believe that this is one of the most important subjects to come before this convention and is first with the General Foreman. The maintenance of a locomotive after it leaves the back shop is a whole lot and the first thing to be considered is the plan of organization. Next is the handling of the work, repairs, etc. The roundhouse foreman should know

how many engines he has in the house and be able to answer the telephone and tell the men off of the reel what he can do and when he can do it. I compile a report in my office every morning, giving a check of the entire number of engines in the house. Another of that style every twenty-four hours. In addition to that our engine house foreman covers a twelve-hour period with a report. I will submit as "Exhibit A" one of these reports so that it may go into the minutes. I will also submit the check of the roundhouse as "Exhibit B" for the same thing, and will also show a report of the engine failures on the Lackawanna R. R.

EXHIBIT "A."

F C P East Bfo Aug 13, 1913
W W

The following engines were in rd house at 7 am.

1225	O.K.	739	5pm	
1227	O.K.	769	6pm	
1207	O.K.	740	3pm	
1222	O.K.	1226	7pm	
1203	O.K.	562	7pm	
1157	O.K.			
553	O.K.	1201	8-15	Blr Wk
792	O.K.	1209	8-15	Blr Wk
750	O.K.	109	8-14	Blr Wk
759	O.K.	548	8-14	Blr Wk
786	O.K.			
99	O.K.			
114	O.K.			
105	O.K.			

1213	10 am
1214	2 pm
785	2 pm
790	4 pm
555	4 pm

Fourteen engineers and twenty-two firemen on entire list this am.
All rd crew on reg eng.

EXHIBIT "D."

East Buffalo, August 10, 1913

Mr. F. C. Pickard D. M. M.
Mr. W. W. Scott Gen. Fore.
Mr. L. J. Ferritor Supt.
Mr. J. R. Hamilton T. T. M.

Gentlemen.

The following engines were dispatched from this station for a period of 24 hours ending August 9, 1913.

Road Power

Engines	Ordered	Delivered	Detentions
1206	12:15	12:15	
1028	2:15	2:15	
509	6:00	6:00	
750	6:30	6:30	
792	6:40	6:35	
549	7:30	7:35	
1110	8:00	7:50	

Yard Power

Engs	Arrived	Ordered	Delivered	Detentions
116	12:59	12:59	12:59	
136	12:18	1:18	1:18	
769	12:15	1:15	1:16	
92	12:23	1:23	1:23	

EXHIBIT "B."

THE DELAWARE, LACKAWANNA & WESTERN RAILROAD COMPANY

Motive Power and Equipment Department

Engines late leaving round house for 12 hours ending 6 o'clock .....M

.....191....

Train	Engine	Engine Arrived	Ordered for	Time Delivered	Cause of Delay

Total No. of engines dispatched..... .....Engine Dispatcher.

.....R. H. Foreman.

.....Gen'l R. H. Foreman.

EXHIBIT "C."

THE DELAWARE, LACKAWANNA & WESTERN RAILROAD COMPANY

Buffalo Division.

July 3, 1913.

Mr. T. E. Clarke,
General Superintendent.

Dear Sir:
Report of non-performance of engines for 24 hours ending 6:00 a. m. 7-3-13

Train	Engine	Engineman	Location	Nature and Cause of Non-Performance

L. J. Ferritor,
Superintendent.

Our interpretation of an engine failure on the Lackawanna may be somewhat different than other roads that I am familiar with. The New York Public Service Commission lays down what an engine failure is. Any delay to a passenger engine, five minutes or over, regardless of whether the time is made up after the failure takes place, constitutes a failure in passenger service; and any delay to a freight engine of twenty minutes or over is a failure. Engine failures are also charged up in switch engine service, which is not done in the Chicago district; so comparisons made of engine failures in the different territories are not fair to the General Foremen as a whole because they are not made on the same basis.

I will also show you a report as Exhibit "C" showing check on classification repairs in the engine house.

Mr. Corbett: We work along on the same order. We have a form to fill out at the time the engine registers in. The length of time that it takes. We have that to fill out every day. We also have a delay report. We get that from the day man and the night man in order to keep a future line up. And the men working in the roundhouse may have an eight-hour shift, three shifts; that necessitates three men, one on each shift. We have another man whose time is put in on packing the cab and putting air through the water glass and lubricator; we have a special man on shoes and wedges; we also have a rod man who does nothing but rod work. And in handling it that way we keep engines up in fairly good condition and I believe keep down a good many engine failures.

The worst thing we have to contend with is bad water that requires an engine to be washed out every trip. And while we have flues down on the failures constantly we ordinarily handle an engine through the house in $3\frac{1}{2}$ to 5 hours.

Mr. Logan: Mr. Smith referred in his paper to organization and the system or method of doing the work which is quite common on the Northwestern. I wish to thank Mr. Smith for the vast amount of time and research that he has put in on this paper. It is one of the most instructive papers that I have ever read.

President Scott: It is to be regretted by all that we cannot give it more attention.

Mr. Shepherd: In my opinion a good mechanic never works in untidy surroundings, and I think the most important item toward roundhouse efficiency is absolute cleanliness. It costs but little. The mere effect of the hostler being instructed to attend to the receiving truck helps out a great deal, so that there can be a general understanding between the engine crew and himself that he will take care of the engine immediately upon its arrival. The fireman is apt to put in an excessive amount of fuel in order to keep the fire until it gets into the hostler's hands, which should not be necessary. A very small bank put under the flue sheet will save thousands of tons of coal in a year. The other item that occurs to me is on outgoing engines. A common practice is for the fire builder to go to the engine several hours before leaving time and build an immense fire. He has the engine full of water before he builds a fire and after he gets the steam pressure up to the pop-off point he moves the engine to the yard. The engine crew, when they go out, they cannot talk too much for the pop valve and that engine howls for an hour. It goes down to the train and they cannot detect air leaks on account of the popping. If the fire builder will give himself just time to put in a good fire with one half a glass of water and then let the fire build up naturally. The engine should be moved out doors as soon as there is steam pressure enough to handle it and fire built up without the aid of the blower. There should be a large leeway between the water and the steam pressure, so that by the natural draft, when the engine goes to the train there is no popping off and waste of fuel, and when he starts it he has a bed of fire in there sufficient to take care of his needs. That is something that is being overlooked on over 75 per cent of the railroads of the United States.

Mr. Pickard: I want to put a twister on that clean roundhouse. Our roundhouses are so constructed that we have a good floor, either brick or square blocks. They are so organized that immediately when the whistle

blows at 7 a. m. four men start out with a hose and get about 120-lb. pressure off of our wash-out plugs and those four men will wash the round house in 45 minutes to an hour. I believe you can wash a roundhouse quicker by that method than any way I have seen. You can clean out all the oil and grease that accumulates in the pits and it certainly looks fine. It is an encouragement to the machinists. The previous speaker refers to an ideal condition. You General Foremen will appreciate that we are not all fixed so that we can fire up an engine without a blower.

We have very good office facilities in our roundhouse for reporting work. We have a registry room where Mr. Engineer comes in and sits down to a desk; opposite that desk we have a boy at about $25.00 or $30.00 a month; the engineer dictates this work to the boy who enters it in a book with ink. It is signed by the engineer in ink. This boy copies the work and subdivides it out to the various foremen to do the work. Any slips that are not taken care of are placed in the unfinished box, and every time an engine shows up at the engine house this unfinished box is checked up by the boy and this unfinished work is turned over to the foreman. A copy of these unfinished slips goes to the Master Mechanic so he can check them up personally and know how much work is being left undone, and make inquiry should he see it is excessive. These slips at the end of thirty days are all put together and sent to the Master Mechanic's office for filing, and for reference should it ever be necessary to see them. The books require the engineer to answer 42 questions, so he has to make a pretty good inspection of his engine. These books are all carried for future reference. At the end of each month we take a balance and compile them under a great number of heads such as hot boxes, valve motion failures, steam failures, and boiler failures, etc. We divide those into the different percentages, make a rigid inquiry as to placing the responsibility, and we never close up an engine failure unless we place the responsibility.

Mr. Logan: I think this topic is of sufficient importance to carry over another year. It certainly has not been threshed out this year as it should have been.

Mr. Pye: I move you that it be made one of the subjects for next year's discussion. Seconded and carried unanimously.

Mr. Pickard: I suggest that the chair appoint a standing committee on Engine House Efficiency.

Mr. Logan: Why not continue the same committee? I move that the appointing of the committee be left to the chair. Carried.

Thereupon the President appointed Walter Smith, the author of the paper, Chairman of the committee and C. D. Ashmore and C. M. Newman members.

Mr. Pickard: I suggest that the Secretary of our Association write a letter to the Hunt-Spiller Co., commending their action in sending a young man of the caliber of Mr. Ellet to our meeting. I do not think he has missed a session. (Applause.)

Mr. Logan, Chairman of the Committee on Resolutions, read the following report, which was unanimously adopted.

Report of the Committee on "Resolutions."

Be it Resolved, That the thanks of this association be given to the committees who prepared and read papers upon the apprentice plan of education in railway shops.

Resolved: That due to the increase of detailed work in connection with the office of Secretary-Treasurer of this association, and the anticipation of greater work during the year 1913-1914, we recommend that the salary of the Secretary-Treasurer be increased from $300.00 to $400.00 per annum, and if consistent that he be placed under bonds to the extent of $1,000.00.

Resolved: That this association extend to Mr. F. C. Pickard, Past President of this association, a rising vote of thanks for his very personal and active interest in the work of this association, and be it further resolved that the example of progressive action taken by Mr. Pickard in the affairs of the association be commended to all future presidents.

Resolved: That this association greatly appreciates the opportunity of visiting the Chicago Northwestern shops, and tender the Management our sincere thanks, for providing a special train for this purpose, and for the many courtesies shown us while at the shops.

Resolved: That the thanks of the International Railway General Foremen be extended to the Supply Men's Association for the many and very interesting exhibits of mechanical appliances at our convention. Be it further

Resolved: That we consider this feature to be of an educational value to our members, and should be visited by all at the conventions. Be it further

Resolved: That we deeply appreciate the many kindnesses from the Supply Men's Association.

Resolved: That this association consider the advisability of holding their 1915 convention at San Francisco; and it is recommended that this resolution be referred to the Executive Committee of 1914 for action.

Resolved: That as an appreciation of valuable services rendered by Mr. J. W. Motherwell, and for the interest he has taken in making our organization successful, that we elect him an honorary member of this association.

Resolved: That the International Railway General Foremen's Association extend to the Manager, Assistant Manager, and staff of the Hotel Sherman, a rising vote of thanks for the many courtesies shown, and privileges granted during their convention.

Resolved: That this association extend to the ladies a vote of thanks for their presence, for it was an added stimulus to the endeavors of all of our members in making our convention profitable and successful. Be it further

Resolved: That we deeply appreciate the thoughtfulness of the ladies present, in forming themselves into an Auxilliary to our association, and be it

Resolved: That we render the ladies all the aid possible in maintaining the Auxillary.

Resolved: That this association show its appreciation to the Railway and Locomotive Engineering, for the publicity of its business in that paper during the past year.

Resolved: That the thanks of this association be extended to the publishers of the Railway Journal, the Railway Age Gazette, and the Master Mechanic for valuable space given in the several issues of those publications.

Resolved: That the thanks of this association be extended to Mr. R. Quayle, Superintendent of Motive Power and Machinery of the Chicago & Northwestern Railway, for the interest he has shown in our association, and his kind words of encouragement to our members during his splendid address at the opening of our convention.

GEO. H. LOGAN, Chairman.
JAMES P. PYE.
C. L. DICKERT.
W. GALE.
W. G. REYER.

Mr. Gale: Before we close I would like to say a few words. We are practically on the eve of the dissolution of this our active sessions. I feel that we are indebted to the Supply Association for many of the comforts which we have enjoyed during the sessions. It is possibly true that it would be more educational and possibly appreciated more by the members, had the Supply Association attended our meetings more frequently. Possibly it might have been for their education and advancement as well as our own, but inasmuch as they are members of a different organization, it is up to them to take up these matters as they wish. And we ought to show our appreciation for the many kindnesses and comforts and pleasures that the Supplymen's Association have extended to us and our ladies. I believe it is due

to them that we acknowledge their service at this time and that we should continue to foster the friendships that we have gained during this convention with the supply men and their association. I believe if we have not all visited the exhibits that have been provided for the supply men and at considerable trouble and cost, that we should do so and show our appreciation of their hard work along the lines of interest for the members of this association.

President Scott: We had a registration at this convention of 78. The faces are different by 75 per cent of what they were a year ago, and it has dwindled down to 10 per cent of the 1911 convention. I cannot understand why our membership don't repeat. I want you to think it over and if you think it worth while, come again. If we can have the same faces that attended this year, this hall will not be large enough to hold them next year. There were 25 admitted here since Mr. Hall came to Chicago and that 25 is a pretty fair representative of what we have here now. I want you to do your best and try to plan ahead far enough, so that there will be no question as to your being here next year and bring your neighbor with you. Our supply men are all out hustling and it is due to their efforts that our membership has been increased.

I want to say to the Executive Committee, I would like to have a meeting before we adjourn to make plans for a meeting to devise ways and means for our next convention.

Mr. Logan: I have a suggestion to make. A great many of us come here; we all have these advance copies of our papers, but a good many are guilty of procrastination. They put off till tomorrow what they should do today, and I have been much impressed by the method that Mr. Dickert adopted; when he is lined up to talk on a subject he has a paper which he has prepared previously. There is a great deal that we come in contact with in our daily work that would interest others, but when we are called upon to speak we are a little bit stunned. I would suggest that our Secretary write a letter to each member asking him to come prepared with notes to talk on a subject.

Mr. Pickard: I suggest that the Secretary continuously keep the various General Foremen before the mechanical field and not let a month pass that some circular letter does not go out, and I suggest that he write immediately to the Master Mechanics and Superintendents of Motive Power and secure the names of the General Foremen, and then write them and give them reasons why he should be a member of the organization; what benefits there are derived and solicit his membership for the next convention. In that way it will put us in touch with the public and no doubt will increase the membership.

Mr. Smith: I do not think that the members properly prepare themselves before hand. I suggest that each one start a little note book. We can find out right away the subjects that are to be discussed next year and we can jot down a note here and there. That is the practice that I have been trying to follow and I think it worked very successfully.

Secretary Hall: I wish to thank the members very kindly for their generous increase in my salary, not so much for the salary itself, but because it shows in a practical manner your appreciation of my work during the past year.

As regards getting advance copies out earlier, will say that it was impossible to do so, owing to the committees in charge of the various topics being so late in sending in their reports; however, I consider thirty days prior to the convention, gives the members ample time to study them, and make such notes as they see fit.

Comment was made in some of the mechanical papers about advance copies of topics for the Master Mechanics' convention, being sent out ..... days prior to the date of convention, so if this was satisfactory, thirty days I am sure is ample for all purposes; and for several reasons, I do not consider it good policy to send them out any earlier.

Mr. Summars: As one of the new members of this association I would like to say that I feel that I have derived a large amount of good from the

discussions that I have heard, and from the various exhibits in the supply room, and I for one feel that I will be a much better man for my Company when I go back, and I shall certainly endeavor to be here next year.

Mr. Scott: I would like to call upon Mr. Wallace for a few remarks. Tell us what it means in a business way to attend these conventions.

Mr. Wallace: I just dropped in here and did not expect to be called upon to make any remarks, although I have been very much interested in what has been said. You have an example here in your retiring president of what a convention will do for you.

I remember years ago I was appointed Traveling Engineer cause I had been running a locomotive and had been fortunate in keeping out of the rear end of a caboose on a freight train, and that is the way I got the job. I went to the boss and told him that the Traveling Engineers were having a meeting in Minneapolis. He said there was nothing to it and I let it go by that year. The next year they met in Chicago and I came down here and I didn't really know how to get into the hotel. But I got a little bit acquainted and I have never missed a meeting of the Traveling Engineers' Association, and I will not miss a meeting if I have to walk to get there.

Just look back. Men who are holding most of the responsible positions in the mechanical departments are the men who started in just like you boys are here today. I could name very many of them. They are Superintendents of Motive Power, and we have some who are General Managers and they are still holding their membership. You men come here not wholly to learn and gain knowledge pertaining to your business but to make acquaintances among the men who attend these conventions; that is going to be of more value to you later on in life than you can anticipate at this time. And after all, if you do a kindness to a fellow the time will come when he will have a chance to give you a little push along, and the next thing you can get in addition to your mechanical ability is a good fellow, and that will come back to you when you lose your hair.

I remember we had a fireman at one time who missed a call, and when they missed a call they had to come down and see me. He came down rather shamefaced because he had lost his turn out, and in investigating the reason of his failure he said "I have a little girl lives out two miles and I went out. to see her and that is why the call boy could not find me." I said possibly you do not understand the importance of notifying the call boy where to find you. That might have meant a serious delay to one of our trains. I am glad you called on the young lady because I think the influence of a good girl on a man or a boy's life is something that you cannot afford to lose, but if you had been in the saloon you possibly would have been suspended. Let the call boy in the next time." A few years ago I was standing in a roundhouse and a man came up to me and said: "How do you do, Mr. Wallace?" I had forgotten him. He said: "Do you remember the time I missed a call?" I said that I had forgotten it. He said: "You gave me a good talking to at that time and I have that little girl at home keeping house for me." These things make life pleasant; they make your success. It does not make any difference how much ability you have, unless somebody knows about it. A kind word here and there will make your life smoother and you will get more compensation for your services as a rule.

I do not know that I can say anything worth taking up your time. I thank you for the time you have given me and the honor you have conferred upon me by allowing me to address this meeting.

President Scott: I wish to thank you, and I want to express my appreciation to you gentlemen for the courtesy you have extended to me. If there is no further business before the meeting we will adjourn sine die.

THE LADIES' AUXILLIARY
To the
General Foremen's and Railway Supply Men's Associations

A very pleasing feature of the 1913 convention was the organization of the Ladies' Auxilliary to the General Foremen's and Railway Supply Men's Associations.

Several very enthusiastic meetings were held in the Rose Parlor of the Hotel Sherman, at which Mrs. H. S. Mann, presided.

The objects of the association are for the purpose of entertaining all members and visitors, and promoting sociability generally.

The following officers were elected to serve for one year:

President	Mrs. H. S. Mann, Chicago, Ill.
1st Vice-President	Mrs. F. C. Pickard, Buffalo, N. Y.
2nd Vice-President	Mrs. G. W. Reyer, Nashville, Tenn.
Secretary	Mrs. W. Hall, 829 W. Broadway, Winona, Minn.
Treasurer	Mrs. F. Bakerfield, The Plaza Hotel, Chicago, Ill.
Page	Mrs. C. M. Newman, Rocky Mountain, N. C.

The following committees were also appointed to serve for one year:

Executive Committee.

Mrs. W. W. Scott, Chairman, Buffalo, N. Y.

Mrs. R. Hogg, Philadelphia, Pa.	Mrs. W. G. Wallace, Chicago, Ill.
Mrs. F. C. Pickard, Buffalo, N. Y.	Mrs. H. D. Kelly, Chicago, Ill.
Mrs. T. G. Lickey, Chicago, Ill.	Mrs. W. G. Reyer, Nashville, Tenn.

Reception Committee.

Miss L. F. Mann	Mrs. Robert Hogg	Mrs. V. W. Ellet
Mrs. L. Chapman	Miss L. Reyer	Mrs. J. W. Motherwell

Auditing Committee

Mrs. B. J. Neely Mrs. H. W. Ensign Mrs. P. F. Flavin Mrs. J. T. Barnes

The following ladies were present and joined the Auxilliary.

Mrs. F. Baskerfield	Chicago, Ill.
Mrs. C. L. Brown	Chicago, Ill.
Mrs. J. T. Barnes	Chicago, Ill.
Mrs. W. G. Cook	Chicago, Ill.
Mrs. L. Chapman	Norfolk, Neb.
Mrs. G. W. Cuyler	Marshalltown, Iowa.
Mrs. H. W. Ensign	Chicago, Ill.
Miss H. Ensign	Chicago, Ill.
Mrs. W. W. Ellet	Fort Madison, Iowa.
Mrs. T. E. Freeman	Two Harbors, Minn.
Mrs. P. F. Flavin	Chicago, Ill.
Mrs. Wm. Hall	Winona, Minn.
Mrs. L. A. Hardin	Boone, Iowa.
Mrs. R. Hogg	Philadelphia, Pa.
Mrs. M. J. Hayes	Hamilton, Ont., Can.
Mrs. H. D. Kelly	Chicago, Ill.
Mrs. T. G. Lickey	Chicago, Ill.
Mrs. R. H. Linderman	Chicago, Ill.
Mrs. H. S. Mann	Chicago, Ill.
Miss L. F. Mann	Chicago, Ill.
Mrs. J. W. Motherwell	Chicago, Ill.
Mrs. A. Masters	Watervliet, N. Y.
Mrs. M. E. Moore	Watervliet, N. Y.

Mrs. C. Mellor	Kansas City, Mo.
Mrs. F. P. Miller	Dubuque, Iowa.
Mrs. C. M. Newman	Rocky Mountain, N. C.
Mrs. L. A. North	Chicago, Ill.
Mrs. T. H. Nanney	Galeton, Pa.
Mrs. B. J. Neely	Chicago, Ill.
Mrs. F. C. Pickard	Buffalo, N. Y.
Mrs. J. Pye	Covington, Ky.
Mrs. J. G. Platt	
Mrs. W. G. Reyer	Nashville, Tenn.
Miss L. Reyer	Nashville, Tenn.
Mrs. W. W. Scott	Buffalo, N. Y.
Mrs. J. C. Shreeve	Joliet, Ill.
Mrs. C. C. Shumaker	Austin, Ill.
Mrs. G. S. Turner	Berwyn, Ill.
Mrs. J. H. Tinker	Danville, Ill.
Miss H. G. Unkenholz	Toledo, Ohio.
Mrs. T. E. Williams	Austin, Ill.
Mrs. J. B. Wright	Columbus, Ohio.
Mrs. H. M. Wey	Columbus, Ohio.
Mrs. W. G. Wallace	Chicago, Ill.

Constitution and By-Laws

ARTICLE I.

The name of this Association shall be: International Railway General Foremen's Association.

ARTICLE II.

OBJECTS.

The objects of this Association shall be the mutual improvement of its members by exchanging ideas by means of annual meetings and the reading and discussion of papers; the general exchange of views along the lines pertaining to railway locomotive shop practice so that we may all profit by the experience of others in our line of railway work, and also be of greater value to the companies employing us and to those for whose interests we labor.

ARTICLE III.

OFFICERS.

Section 1. The officers of this Association shall consist of a President, a First Vice-President, a Second Vice-President, a Third Vice-President, a Fourth Vice-President, and a Secretary and Treasurer, all of whom shall be elected by the Association at the annual convention, and who shall serve for one year or until his successor is elected, also an Executive Committee of Five who shall be appointed by the President, and shall continue in office until their successors are chosen.

Section 2. No man shall be eligible to the offices of President, Vice-President or the Executive Committee who are not active members of the Association at the time of the annual election.

ARTICLE IV.

ELECTION OF OFFICERS.

The election of officers of this Association shall be by ballot at the annual meeting. They shall be elected separately, and a majority of all votes cast shall be necessary for a choice.

ARTICLE V.

DUTIES OF THE PRESIDENT.

It shall be the duties of the President to preside at all the meetings of the Association; to appoint all committees designated by the Association by the officers and Executive Committee jointly; decide all points of order; announce the business before the Association; receive and submit all motions duly made by the members; put to vote all motions regularly made, announcing the result and only voting in case of a tie; and he shall exercise general supervision over the affairs of the Association.

ARTICLE VI.

DUTIES OF VICE-PRESIDENTS.

It shall be the duties of the Vice-Presidents to assist the President in such duties as he may require of them pertaining to the conduct of the affairs of the Association; and in case of the absence of the President the Vice-Presidents shall preside according to the order in which they are chosen, the First Vice-President taking the position of President in case of the absence of the President, if the First Vice-President is present, etc. If in the event that both the President and First Vice-President are absent, the second Vice-President then shall act as President, etc.

ARTICLE VII.

DUTIES OF SECRETARY-TREASURER.

The Secretary shall also act as Treasurer of this Association. It shall be his duty to keep a correct record of the Proceedings at all meetings of the Association; to attend to all correspondence; to keep a record of the membership; to receive all moneys, and to pay all bills of the Association when approved by the President. He shall also take charge of all books, records, papers, and other property of the Association, and perform such other duties pertaining to his office as may be required of him by the Association.

ARTICLE VIII.

DUTIES OF THE EXECUTIVE COMMITTEE.

Section 1. The Executive Committee shall exercise a general supervision over the Association not included in the duties of the President; recommend the annual assessments; to call, to prepare for and to conduct any special conventions; shall authorize the Secretary-Treasurer to make all necessary purchases, expenditures and contracts required to conduct the current business of the Association. They shall have no power to make the Association liable for any debts to an amount beyond that which at the time of contracting same, shall be in the hands of the Treasurer, and not subject to prior liabilities. All expenditures for special purposes shall only be made by the Association through appropriations acted upon at the regular meetings.

Section 2. The Executive Committee shall have a report of the regular meetings compiled by the Secretary, such report to be made accessible to each member of the Association; it shall have power to withhold from the published proceedings, papers and reports and discussions containing old matter readily found elsewhere, those especially meant to advocate personal interests, those carelessly prepared or controverting well established fact, and those purely speculative or foreign to the purpose of the Association, or any which, in the opinion of the Executive Committee, are unworthy of publication; this discretion shall always be exercised subject to the approval of the President.

Section 3. Two-thirds of the members of the Executive Committee may call special meetings of the Association to be held not less than thirty days after notice thereof has been mailed to each member of the Association. They shall also have power to change the place of the regular meetings with the sanction of the President.

ARTICLE IX.

MEMBERSHIP.

Section 1. Active members shall consist of Railway General Foremen, Division Foremen, Superintendents of Shops, Machine Shop Foremen, Roundhouse Foremen, and their assistants, who are in charge of railway locomotive shops, and who have been in active service for not less than one year prior to date of application.

Section 2. No active member shall be barred from his privileges as such on account of promotion or change in active railway service, he shall no longer be considered an active member after expiration of the year for which he has paid dues.

Section 3. Associate members shall consist of men who have been Foremen or Assistant Foremen in railway locomotive repair shops or in a roundhouse, or otherwise whose experience shall be valuable to the Association. Such members shall not have the privilege of voting.

Section 4. Honorary members shall consist of those who have been active members, and on account of old age or ill health, have been obliged to retire from active service. Such members shall not be required to pay dues.

Section 5. Applicants for membership shall submit their request in writing, give name and title, and name and address of the road by which they are employed.

Section 6. Application for active membership must bear the recommendation of the Master Mechanic or Mechanical Engineer or Superintendent of Motive Power of the road by which the applicant is employed, or else must bear the recommendation of an active member in good standing.

ARTICLE X.

FEES AND DUES.

Section 1. The admission fee in this Association for membership shall be Five Dollars ($5.00), which includes the year's dues, which amount shall accompany the application to the Secretary, and such application should be sanctioned by the Executive Committee and receipt then given to the applicant by the Secretary.

Section 2. The annual dues of the Association shall be Three Dollars ($3.00), which amount must be paid to the Secretary at the beginning of each new year of the Association.

ARTICLE XI.

MEMBERS IN ARREARS.

Members in arrears for dues may hold seats in the convention but such members shall not be entitled to a vote until such arrears are paid. After the expiration of two years the Secretary shall notify such members that they will be suspended for non-payment of dues.

ARTICLE XII.

MEETINGS.

Section 1. The regular annual meetings of the Association shall be held during the month of July, the date and place to be designated by the Executive Committee who shall instruct the Secretary to notify each member at least ninety days before the time of convening.

Section 2. Quorum—Fifteen active members at any meeting shall constitute a quorum for the transaction of business, but any less number shall have power to adjourn to any time they may deem proper.

ATRICLE XIII.

AMENDMENTS.

No article or clause to the foregoing constitution shall be altered, amended or repealed except at an annual meeting, and then only by a two-third vote of the active members present.

That the Executive Committee be elected by this Association instead of being appointed by the chair. (Amendment passed September, 1905).

That two members of the Executive Committee shall be elected annually. (Amendment carried 1908).

The following order of business was adopted June 1, 1909:

1. Opening prayer.
2. Address by the President.
3. Approval of minutes of last meeting.
4. Report of Secretary-Treasurer.
5. Appointing of Auditing Committee.
6. Unfinished business.
7. New business.
8. Report of committees.
9. Miscellaneous business developed during session.
10. Reading of papers and discussion of questions propounded by members.

*11. Election of officers.

12. Adjournment.

*Special order for second day of session by amendment to By-laws, 1907.

Note.—Executive Committee to meet for election of Chairman and Secretary before final adjournment is taken.

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